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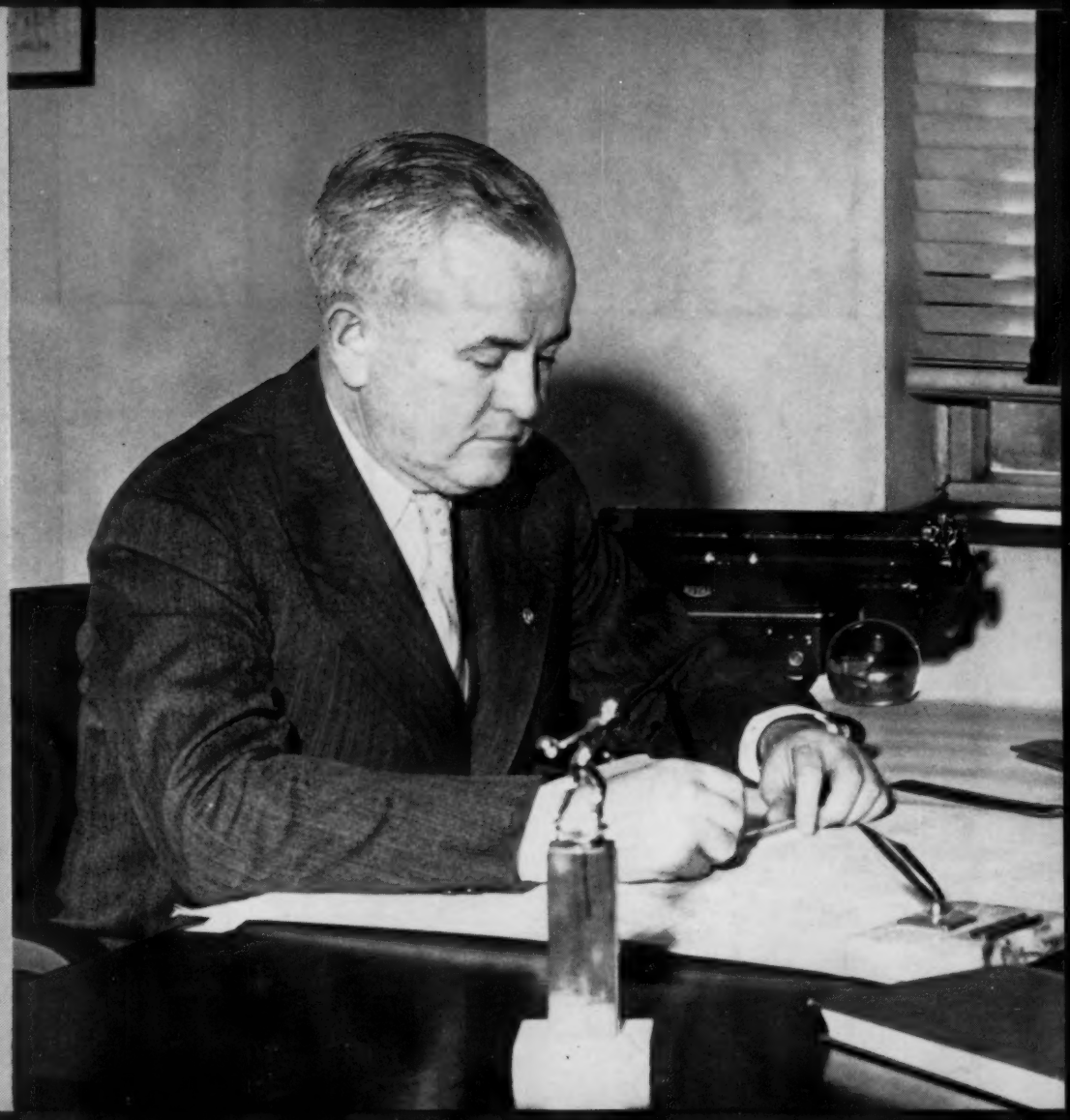
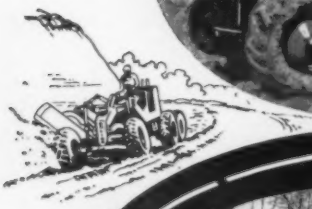


[illegible] consulting engineer, [illegible] Liberty, [illegible] He handles [illegible] variety of work, but has specialized in the design and construction of supportine high-rate filter plants. [illegible]

MORE MILES PER GALION

All across the country you'll find GALION Graders giving unsurpassed performance and service — on all kinds of terrain under all kinds of working conditions. The ground may be clay, sand, stony, loam, shale — wet or dry — makes no difference — size for size, GALION Graders will give you more miles of work accomplished per day. Write for literature.



GALION GRADER ATTACHMENTS

HYDRAULIC SHIFTABLE MOLDBOARD

Greatly increases maximum extension of moldboard beyond rear tires. Without changing the course of grader or position of circle, or working plane of blade, operator can quickly shift moldboard to avoid hitting culverts, abutments, mail boxes, guard rails, etc. Another performance booster in achieving more miles of work per Galion Grader.

OTHER ATTACHMENTS

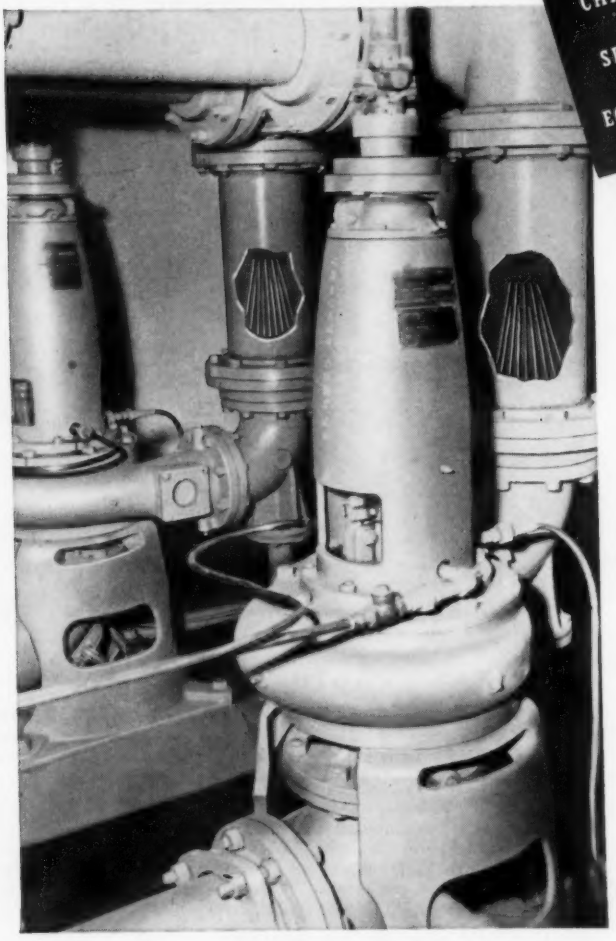
Creeper Transmission · Bulldozer · Snow Plow and Wing · B & L Elevating Grader Attachment · Scarifier · Enclosed Cab · Right or Left 2-ft. Moldboard Extensions.

ESTABLISHED GALION 1907

MOTOR GRADERS · ROLLERS

TRENCH ROLLERS · PORTABLE ROLLERS · 3-WHEEL ROLLERS · TANDEM ROLLERS · MOTOR GRADERS

THE GALION IRON WORKS & MFG. CO., General and Export Offices, Galion, Ohio, U.S.A.
Cable address: GALIONIRON, Galion, Ohio



CHICAGO SEWAGE EQUIPMENT

FLUSH-KLEEN® Sewage Ejectors

More than 12,000 installed in lift stations, buildings and ships

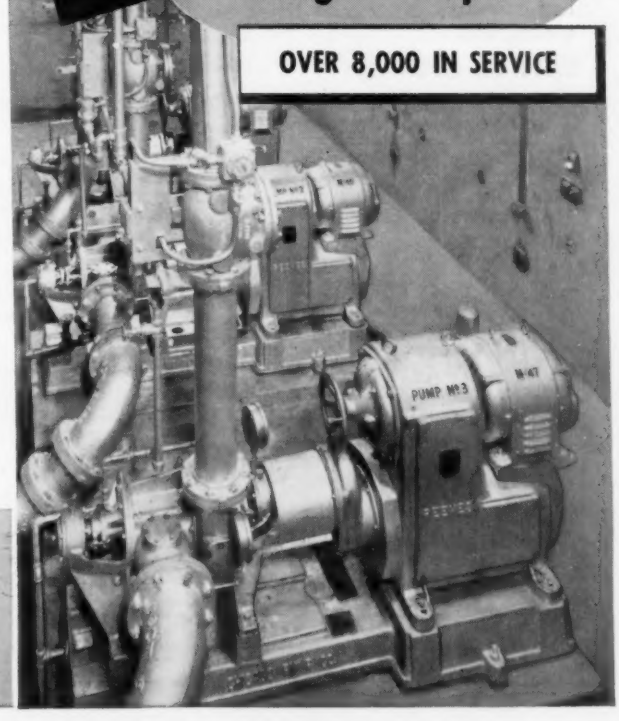
Flush-Kleen sewage ejectors can't clog because rags never reach the impeller. Specially designed strainers in the discharge line retain all coarse matter. Sewage flows over the strainer and through one of the pumps to the wet well. When the pumps operate alternately they pump only strained sewage. No rags or coarse material ever pass through the pump casing. Each strainer is automatically flushed clean during its pumping cycle.

One of 11 Flush-Kleen sewage ejector lift stations installed in the City of Portland, Oregon. The discharge line has been cut away to show the strainer. These stations were designed by Stevens and Koon the Engineers for Portland Sewerage Project.

CHICAGO SEWAGE EQUIPMENT

SCRU-PELLER® Sludge Pumps

OVER 8,000 IN SERVICE



Scru-Peller pumps are designed specifically for pumping primary sludge, are positive in operation and truly clog-proof.

Continuous multiple shearing action is provided by stellited cutting edges of the screw and eight stellited cutting bars positioned in the screw and pump housings.

Heavy-duty ball bearings at each end of the screw and impeller shaft eliminate strain and vibration, permitting pump to withstand sudden and severe overload shocks.

Three of the 27 Scru-Peller pumps installed at the Hyperion Sewage Treatment Plant, Los Angeles, California. Board of Public Works and Metcalf & Eddy, Engineers.

Write to Department J

CHICAGO PUMP COMPANY
Subsidiary of Food Machinery and Chemical Corporation
SEWAGE EQUIPMENT DIVISION
622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors

fmc

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IT'S HERE—CATERPILLAR ANNOUNCES THE

D9

230 HP (Drawbar)

56,200 LB.

Another example of Caterpillar leadership in action!

THE D9... PROVEN IN THE FIELD FOR A YEAR!

Though new, the CAT* D9 is already a veteran. After exhaustive proving tests, several D9s have been tested for over 19,128 hours on the toughest jobs in logging, construction, mining and quarry work. These jobs tested every square inch of this mighty new machine. The word from the field: "By far the best big tractor ever made."

RUGGED—AND EASY TO SERVICE!

From its one-piece welded steering clutch case-frame assembly, to its track shoes hardened by the "Water Quench" process, the D9 is the toughest crawler built. And, it's designed for easy servicing. Oil clutch, torque converter, transmission case and steering clutches can each be removed individually without disturbing other components. Hydraulic track adjusters make service easier, too.

EASY TO OPERATE!

—The independent "live shaft" drive for cable controls makes operation smoother, easier.

—Hydraulic boosters provide power steering *and* braking.

—Adjustable seat, all-around visibility, easy access to all controls make operator's job simpler.

—7-roller track frame improves stability and ride.

—New starting engine has electric starting system and simple single-lever control for easy operation from the seat and insures fast starts in all weather.

All in all, the new D9 sets a new standard of big, money-making, earthmoving performance. Get the full facts about this rugged giant from your Caterpillar Dealer.

MAIL TODAY!

CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

I'd like more information on the D9.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

FAST FACTS ON THE D9

FIRST TRACK-TYPE TRACTOR WITH TURBOCHARGER! The D9's new Turbocharger is driven by the engine exhaust, utilizing energy which would otherwise be lost. Packs air into engine according to engine *load*, not speed; means more working HP — greater performance.

CHOICE OF TORQUE CONVERTER OR DIRECT DRIVE! Two types of drive are available, the exclusive Caterpillar oil clutch with six-speed (forward and reverse) transmission or a three-stage torque converter with 5:1 torque ratio. The transmission used with the torque converter has three speeds forward, two reverse. This option enables you to match the drive you want to your job requirements.

COMPLETELY NEW 286-HP ENGINE! In addition to the Turbocharger, the powerful new D9 Engine features a 6¼" bore and 8" stroke and runs at 1200 r.p.m. Long life and dependability are promoted by stationary oil jet piston cooling; short, rigid valve push rods give smooth, accurate valve action; "Hi-Electro" hardened gear at rear of crankshaft drives timing gears and accessories; other advanced features.

WIDE RANGE OF OPERATING SPEEDS!

Torque converter: 3 speeds forward, 0 to 4.1 m.p.h., 0 to 5.7 m.p.h., 0 to 7.8 m.p.h. • 2 speeds reverse, 0 to 4.1 m.p.h., 0 to 7.8 m.p.h.

Direct drive: 6 speeds forward, 1.6, 2.1, 2.9, 3.9, 5.0, 6.8 m.p.h.
6 speeds reverse, same

CONSTANT-POWER DRIVE FOR REAR-MOUNTED EQUIPMENT! You always have power for cable controls, direct from the engine's rear power take-off. This makes cable control operation completely independent of flywheel clutch or torque converter, boosts operating efficiency.

EQUIPMENT: New Caterpillar-built 'Dozers for the D9: the No. 9S Bulldozer, modified straight blade; the No. 9A Bulldozer, angling blade. New Caterpillar-built Cable Controls: the No. 29 rear-mounted, double drum; the No. 30 front-mounted, single drum.

SPECIFICATIONS: Length 17' 10¾", width 9' 11¼", height 8' 9", gauge 90", approx. wt. 54,000 lb. dry — 56,200 lb. operating.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

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PUBLIC WORKS MAGAZINE

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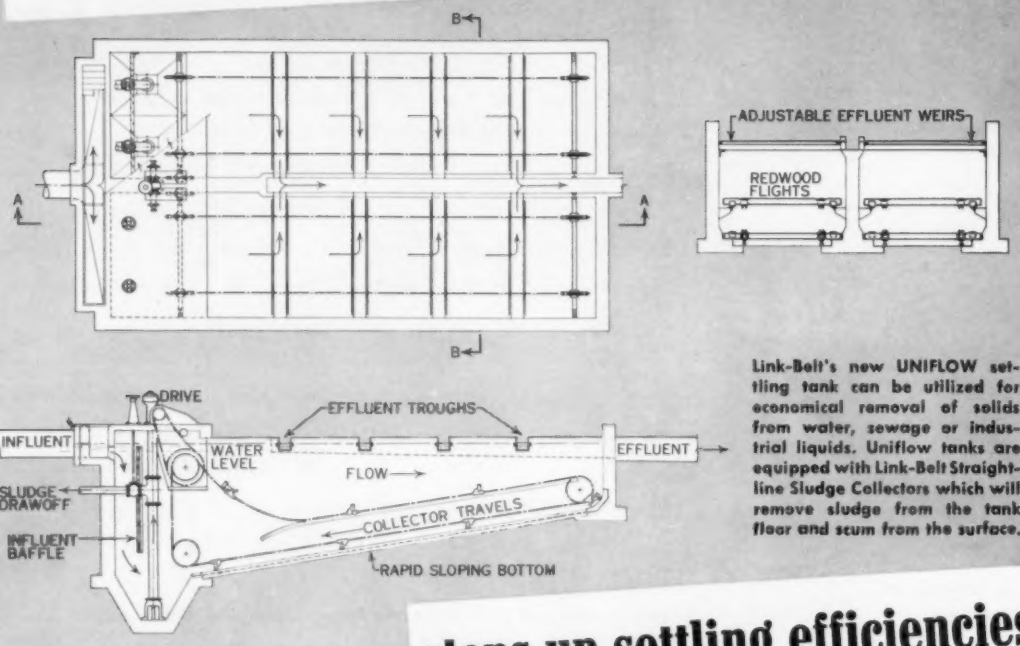
THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

New UNIFLOW settling tank



Link-Belt's new UNIFLOW settling tank can be utilized for economical removal of solids from water, sewage or industrial liquids. Uniflow tanks are equipped with Link-Belt Straight-line Sludge Collectors which will remove sludge from the tank floor and scum from the surface.

steps up settling efficiencies . . cuts construction costs

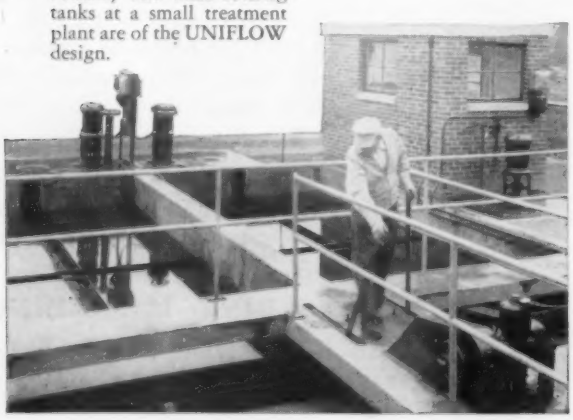
LINK-BELT development offers new economies for water, sewage and industrial liquids treatment

WITH its rapidly sloping bottom and multiple effluent weirs, Link-Belt's new UNIFLOW settling tank represents a big design advance. These, combined with the decreasing cross sectional area, provide *uniform velocity throughout the tank.*

Result: Better settling conditions . . . low overflow rate . . . uniform discharge from a large area of the tank surface. In fact, on one New England experimental installation, UNIFLOW gave practically the same efficiency in B.O.D. and suspended solids removal as a conventional tank with one-third more volume.

The new economies possible with UNIFLOW are typical of the development work constantly under way at Link-Belt. If you have a water, sewage or industrial waste problem, our engineers will work with your engineers, chemists and consultants. They'll help you get the finest in modern treatment equipment.

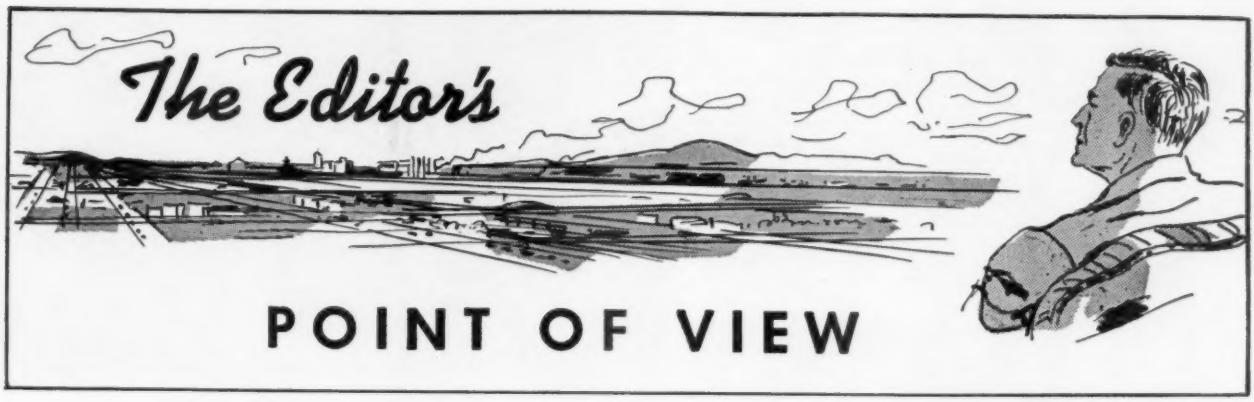
Primary and final settling tanks at a small treatment plant are of the UNIFLOW design.



LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.463

LINK-BELT

SANITARY ENGINEERING EQUIPMENT



Take Care That You Get Your June Issue of Public Works

IN our June issue there will be six pages of outstanding four-color illustrations of special value to water works men. Judging from past experiences there will be many requests for replacement of copies "lost in the mail." This will result from the office staff getting first look at this issue and taking it home or locking it up in the desk. It will not be possible for us to replace these "lost" copies, so we urge our readers to check promptly for the arrival of the June issue and take measures to safeguard it. It should arrive around June 1, or a little later depending on the section of the country.

Reprints will be available of the illustrations and of the accompanying article and these can be ordered at the prices shown in the June issue. So safeguard your own copy of Public Works and order reprints for your staff for reference and use in the future. For maximum usefulness, the reprints will be made up with the color illustrations printed on only one side of the sheet.

Sanitary Engineering for the Armed Services

IN our February issue, in commenting on the reserve program of the Public Health Service, we made some slighting remarks on sanitary engineering in the armed services. The Navy reacted in a manner that we like, for it showed pride of service; there was no word from the Army or Air Force.

The Navy reaction was, however, based on a serious misconception of what is needed. The letters received pointed with pride to the sanitary engineering services in the various area and base public works offices. We agree that these are excellent, but this is only a small part of the problem. If this country should again be obliged to fight in tropical areas and in other unhealthy portions of the world, who will furnish the skills to insure in the field adequate protection against malaria, plague, water-borne diseases, scrub typhus and the host of other maladies which can destroy quickly the effectiveness of any fighting force, no matter how well trained or well equipped? Obviously, the sanitary engineering skills available at an established base will be of no benefit to the combat troops in the field.

These considerations were pointed out in replies to the various Navy letters. The silence has been practically deafening—and ominous. Has no one even thought about the terrible needs for sanitary engineering skills to conserve the strength of the combat troops?

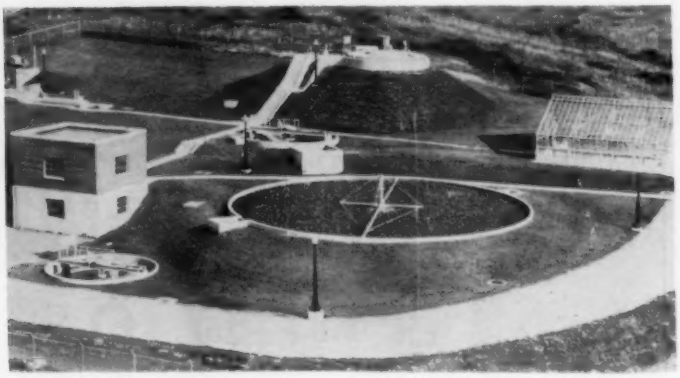
That Place to Park

FINDING a place to park is not solely a modern problem, for the saying is that Noah spent some 40 days trying to find a place to park his ark; but that does not have much to do with our present-day job of solving the problem. There is also comment to the effect that a research problem is now being pressed to find a suitable portable parking place—that one can roll up and carry in his car. It would indeed be a great invention.

It isn't getting much easier, in the meantime, to find that needed parking place, but we do think progress is being made. There is a growing trend, all to the good, for more off-street parking facilities. Engineers, who are the logical folks to solve the problems, are turning their talents to this as one of the necessary steps in getting cars off the streets. Solutions must be based on good engineering and must utilize both community and private resources

Buying For Less May Cost Much More in Maintenance

STANDARDIZATION of equipment is always desirable as it promotes and permits such advantages as interchangeability of parts, reduction in inventory and lower maintenance costs because personnel are familiar with the details of construction. For these reasons, there ought to be a good deal of hesitation and a realistic appraisal of hard facts before letting a minor first cost benefit influence a purchase. Since imports of certain kinds of water works supplies are now reaching this country, these considerations are becoming important. Water works administrators should have the courage to insist on such purchases being made for the long-range, not the short-range, benefits of the community.



Western State Hospital, Virginia, new sewerage treatment plant. Dorr Distributor, Clarifiers, and Digester. TFFI specification blocks. Consulting Engineers, Wiley & Wilson, Lynchburg, Va. Contractors, Bowerman Brothers, Berryville, Va.

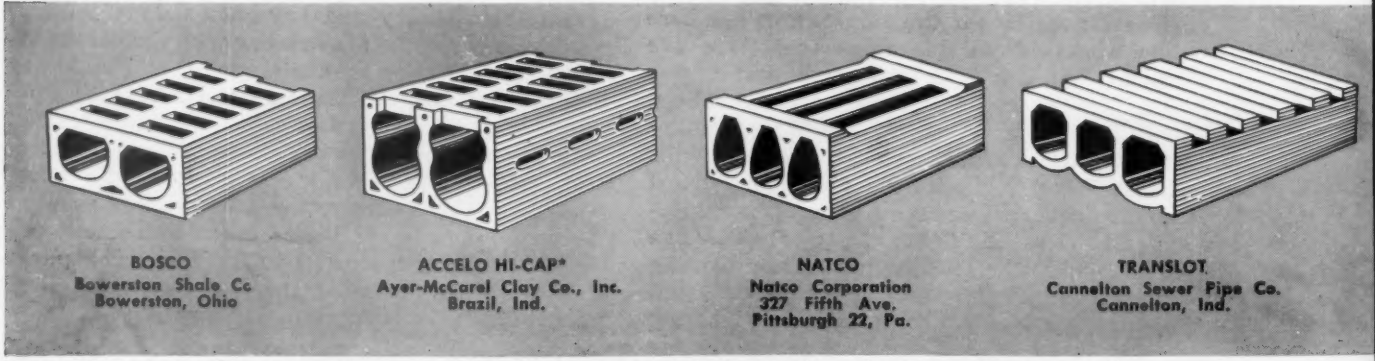
IT'S THE SAME STORY ALL OVER

. . . use *TFFI underdrains*

- Vitrified clay floor blocks add immensely to these 6 important advantages of trickling filters: (1) LOW COST, both initially and in operating; (2) EASE AND SIMPLICITY OF OPERATION. In most plants one 40 or 44-hour a week man can do the work; (3) LONG LIFE; (4) GOOD RESULTS — top-notch efficiency; (5) RELIABILITY, day after day, and year after year; (6) OVERLOAD IS NO PROBLEM. Take temporary shock loads in their stride.

Wymore, Neb. Accelo filter by Infilco, Inc. Armcre TFFI blocks by Ayer-McCarel Clay Co., Brazil, Ind. Consulting Engineers, Harold Haskins & Associates; Contractors, Chambers Construction Co., both of Lincoln, Neb.

TRICKLING FILTER



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

ACCELO HI-CAP*
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.

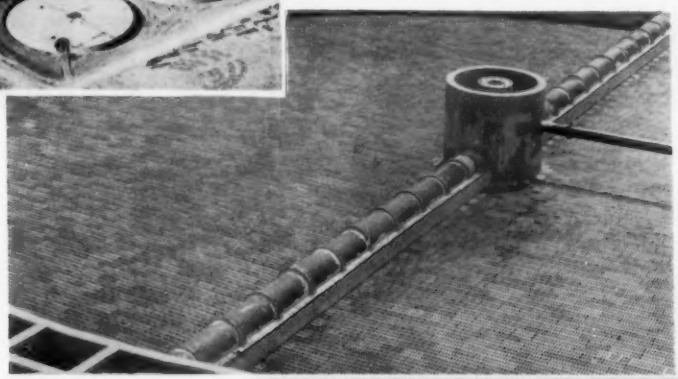
TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

*Reg. Trade Mark of Infilco Incorporated.

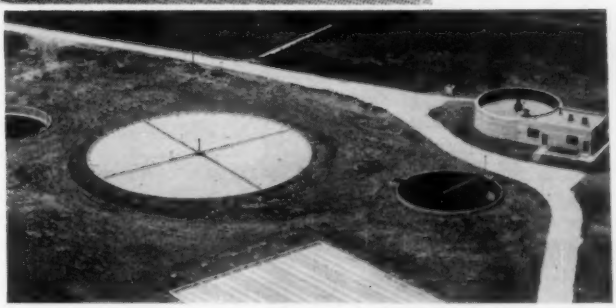
It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Dallas, Texas, White Rock sewerage treatment plant; eight 176-foot trickling filter units. Translot TFFI blocks by Texas Vitrified Pipe Co., Mineral Wells, Texas. Engineers, Powell & Powell, Dallas; Contractors, Cullum & Whittle.

Warrensburg, Mo. plant. Floor tile is TFFI specification, by W. S. Dickey Clay Mfg. Co., Kansas City, Mo. Engineers, Haskins, Riddle & Sharp, Kansas City. Contractors, B. & G. Construction Co., Warrensburg, Mo.



THE U.S.A.



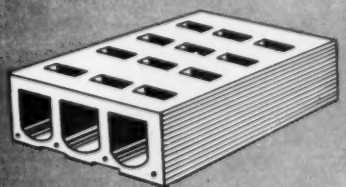
Monticello, N. Y. plant. 2 mgd. Biofilter. TFFI specification blocks. Engineers, Olney Borden, Liberty, N. Y., and W. A. Hardenbergh. Contractors, McElwee Courbis Const. Co., Camden, N. J.

Independence, Mo. TFFI vitrified clay filter bottom blocks supplied by Ayer-McCarel Clay Co., Brazil, Ind., as nearby W. S. Dickey Clay Mfg. Co., was completely sold out.

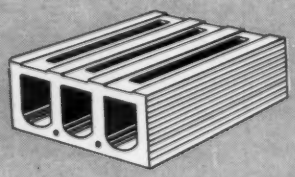
TFFI SPECIFICATIONS

for underdrains are contained in pages 37 and 38 or the new TRICKLING FILTER HANDBOOK, third edition, under "Standard Specifications for Vitrified Clay Filter Blocks for Trickling Filters." Available from any TFFI member.

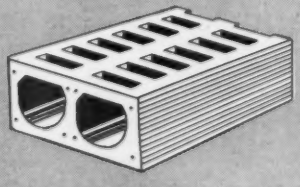
FLOOR INSTITUTE



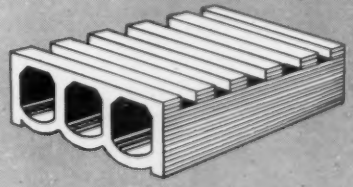
DICKEY
W. S. Dickey Clay Mfg. Co.
902 Walnut St.
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, N. Car.



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

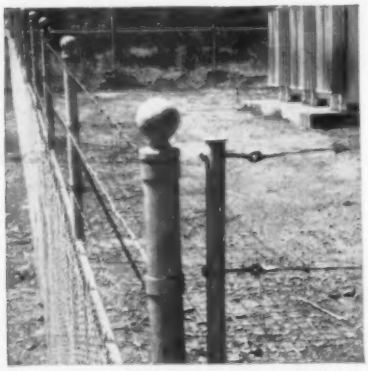


TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas.

Weed and Brush Control lasts longer with Du Pont TELVAR® and AMMATE®

Weed Killers **Weed and Brush Killer**

"Telvar" has kept this yard clean of vegetation for two years.



Note thorough job "Telvar" did around this fence. "Telvar" won't corrode fence or equipment; it's non-flammable, non-volatile.

Heavy weed growth around pole was controlled with one application of "Telvar." It's easily applied and extremely low in toxicity to humans and animals.

One application of "Telvar" solves weed problems for a season or longer!

"Telvar" kills through the roots . . . prevents regrowth. Low dosages (20 to 80 lbs. per acre) make it cost little for the results you obtain. Low rates also mean less handling, less storage facilities. If you're looking for a way to cut maintenance costs to new low levels, include "Telvar" in your weed-control program. Available in two formulations: "Telvar" W; and "Telvar" DW, which is especially suited for light, sandy soils and in areas where annual rainfall is higher than 20 inches.

"Ammate" kills more kinds of brush and keeps it down longer than most weed and brush killers!

When the original spray job is well done, brush is kept under control with nothing more than an occasional spot spray later. You can rely on "Ammate" to do the job safely, even where your rights-of-way adjoin crop land, because "Ammate" is not volatile. There are no vapors to drift onto sensitive crops.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. For your copies, write to Du Pont, Grasselli Chemicals Dept., Rm. D 4038, Wilmington, Del. In Canada—Du Pont Company of Canada Limited, Montreal, Box 660, Canada.

TELVAR® Weed Killers **AMMATE®** Weed and Brush Killer

On all chemicals always follow directions for application. Where warning or caution statements on use of product are given, read them carefully.

DU PONT
REG. U. S. PAT. OFF.

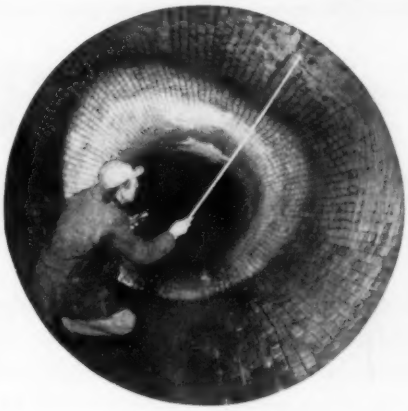
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

"Ammate," applied five years ago, is still keeping brush down along this right-of-way.

Maintenance crews prefer "Ammate" because they can use it without hazard to themselves, livestock, wildlife or adjoining crops.

Same right-of-way as above, three years after treatment. Brush still under control; low-growing cover returned to resist erosion.

Thousands use our Readers' Service card to keep up to date . . . do you?



Note distorted crown
of the old brick sewer.

Are Your Sewers Failing?

You won't know unless you look. Failing sewers often keep their secret until it is too late.

In Milwaukee, inspection showed an old 96-inch combined brick sewer was at the point of failure. Various materials were considered for the repair job, but Armco ASBESTOS-BONDED Sewer Pipe was finally selected. It was strong, corrosion-resistant and its installation would not disturb the existing structure or materially reduce the waterway area. The pipe was installed in 8- to 20-foot lengths, reducing the number of joints required. Costs were low.

Armco Corrugated Metal Pipe is also widely used for new sanitary and storm sewers as a safeguard against future trouble and expense. Why not write us today for details? And don't forget about planning an inspection for your present sewer. It may save trouble later on. Armco Drainage & Metal Products, Inc., 3615 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

ARMCO SEWERS

Armco ASBESTOS-BONDED Corrugated Pipe used for lining Milwaukee sewer. PAVED-INVERT protects against erosion.

When the job calls for a

Cast iron pipe water line installed in front of Marshall Field's in Chicago during subway construction.

Installing mechanical joint cast iron pipe to carry mine water for an Alabama Coal Company.

Rugged *is* the word for cast iron pipe. When you stop to think that cast iron water and gas mains—cast without benefit of modern metallurgical science and production skills – are in their *second century* of service in over sixty American cities, you agree that rugged *is* the word for cast iron pipe. Then, take note of the fact that *modernized* cast iron pipe, centrifugally cast, is even tougher, stronger and more uniform in quality, than the product of a century ago. For further information, write Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3.

CAST Q IRON ®

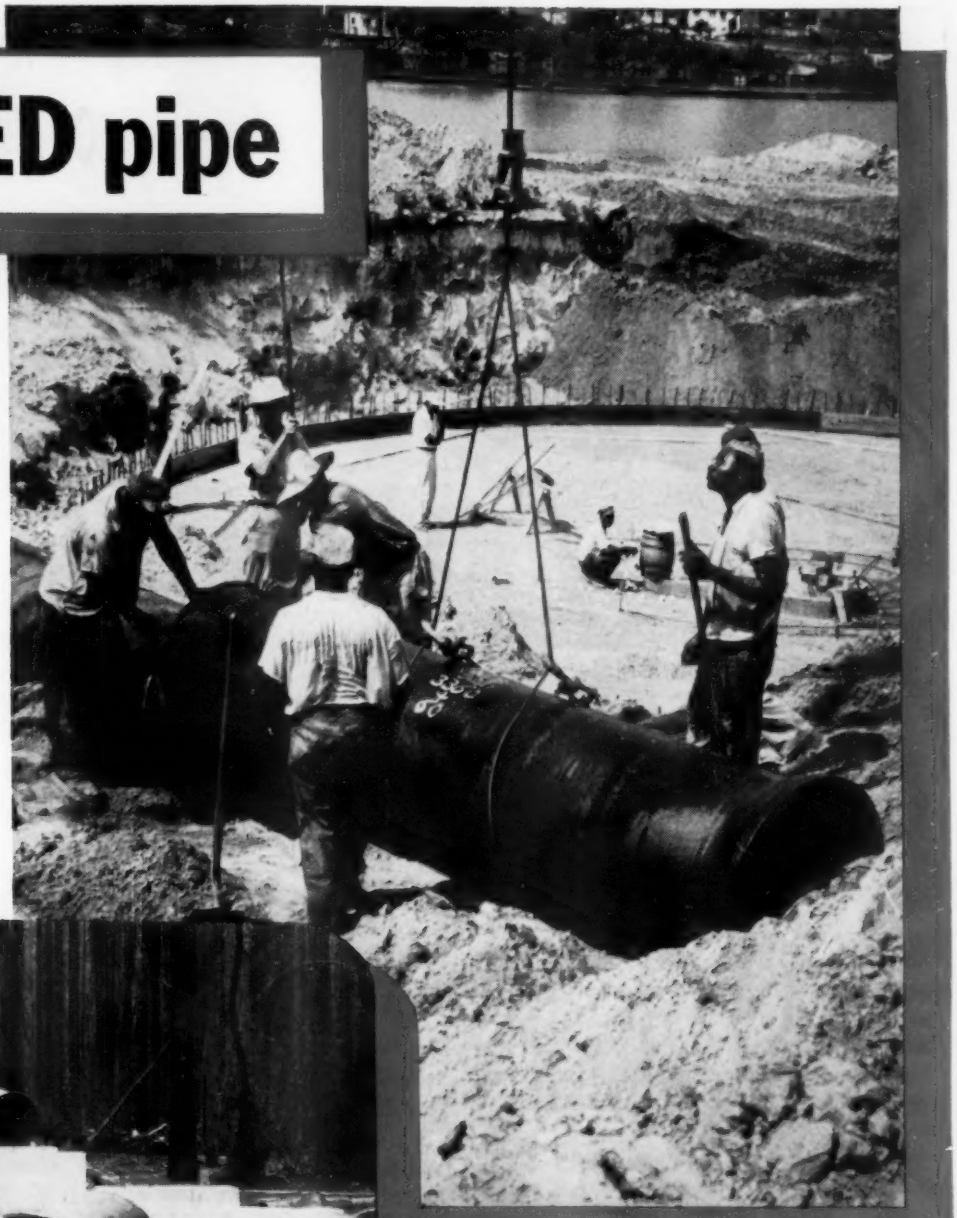
The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

24-inch mechanical joint cast iron pipe for gas supply line at Skokie, Ill.

CAST IRON PIPE

Now's the time to mail this month's Readers' Service card.

RUGGED pipe



Laying 30-inch cast iron pipe for sewage treatment plant at Panama City, Florida.

Cast iron pipe line on piers to maintain grade from sewage treatment plant to outfall—at Durham, N. C.

SERVES FOR CENTURIES . . .

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

modern
announces a
revolutionary new
ANTI-ALGAE

BERKITE NO. 13

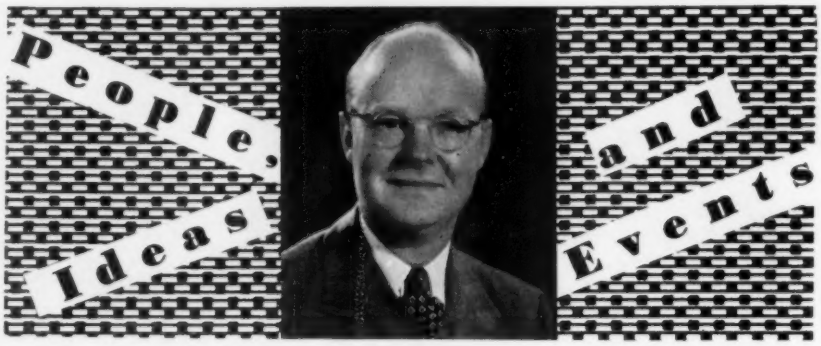
Guaranteed
to destroy and prevent algae
in lakes, swimming pools,
cooling towers

Berkite No. 13 is the anti-algae *"wonder-drug"* reported in trade magazines as a safe, fast-acting algae preventive that's economical enough for large swimming pools, lakes and reservoirs. Developed by *Modern*—leading manufacturers of water treatment chemicals and swimming pool supplies since 1935. Tests show that when used as directed, one gallon of *Berkite No. 13* treats a million gallons of water; destroys algae spores before they develop. Destroys even heavy, slimy algae growth with no harmful effects to swimmers, fish, birds, animals. One treatment effective for a month or more! *For clear, sparkling water order Berkite No. 13 now!* Case of 4 gallons $48.00. Single gallon $12.50.

Write for 44-page Catalog No. 13 and name of nearest distributor.

SEND FOR FREE CATALOG OF POOL SUPPLIES

modern
SWIMMING POOL CO., INC.
ONE HOLLAND AVENUE
WHITE PLAINS, N. Y.



by "Doc" Symons

H.T.M.A. — And once more I want to remind you to make your reservation for the Chicago AWWA Convention, June 12-17. It ought to be a record breaker, in more ways than one. Ed Alt and all the boys from Chicago promise to make your visit worthwhile.

★ ★ ★

This is public relations—and at its best! The Jamaica (L.I.) Water Supply Co. has distributed a booklet to its customers, in an effort to show how to use water correctly in household tasks. Titled, "Do You Know How To Boil Water", the booklet is humourously illustrated with such characters as "The Puzzled Bather". It gives practical advice on soap vs. detergents, the best water temperature for laundering, how long to brew tea, distilled water vs. tap water for the electric steam iron, and the most efficient way to fix leaky taps, and other topics.

Daniel J. Hennessy, President of the Jamaica Water Supply Co., will probably want to shoot me for suggesting this, but if you want a copy write to Mr. Hennessy at 161-20 89th Ave., Jamaica 1, New York.

★ ★ ★

Swedefinition — Married couple; two people who sit on the porch swing to get fresh air.

★ ★ ★

May I nominate? — When Bill Orchard decides to retire as the perennial Master of Ceremonies at the AWWA Convention festivities, I'm going to nominate Mark Stuppy, Sales Mgr., F. P. Leopold Co.—Mark, if you didn't know, once was a professional trombonist; plays piano, composes music and sings—and has a pretty wife who is a delight on the dance floor.

I got to thinking about this idea when I ran into Mark at the N. Y. Sew. & Ind. Waste Assn. meeting in N.Y.C. in January. What he was doing at a sewage meeting (he sells water filter bottoms), I never did find out.

★ ★ ★

What's in a word? — Guy E. Griffin, Deputy Commissioner of Public Works of Westchester County (N.Y.) has the County Sewer Division under his wing. Imagine his surprise as well as those of his coworkers when he read this headline in the White Plains Reporter Dispatch — "Dressmaking Teacher Gives County Sewers Stylish Look."

★ ★ ★

I Never Knew Till Now — In the Nat. Bd. of Fire Underwriters Rating System you can get minus marks for having four-inch pipe in the distribution system. *But*, you don't get any plus marks for having a complete 6, 8, or 12-in. grid around those 4-in. pipes; or if tests show that hydrants in the area (on 6-in. pipe) deliver the required flow; or if pressures at all points are sufficient to deliver desired fire flow at all times.

At the N. Y. Sect. (AWWA) annual mid-winter luncheon I heard Wendell LaDue of Akron, Ohio, and Burton S. Grant of Los Angeles, Calif., bemoaning this state of affairs.—It doesn't quite seem fair to have only minus ratings and receive no credit for plus values.—I'll have to ask Dick Ellis of Factory Mutual, "How About That?"

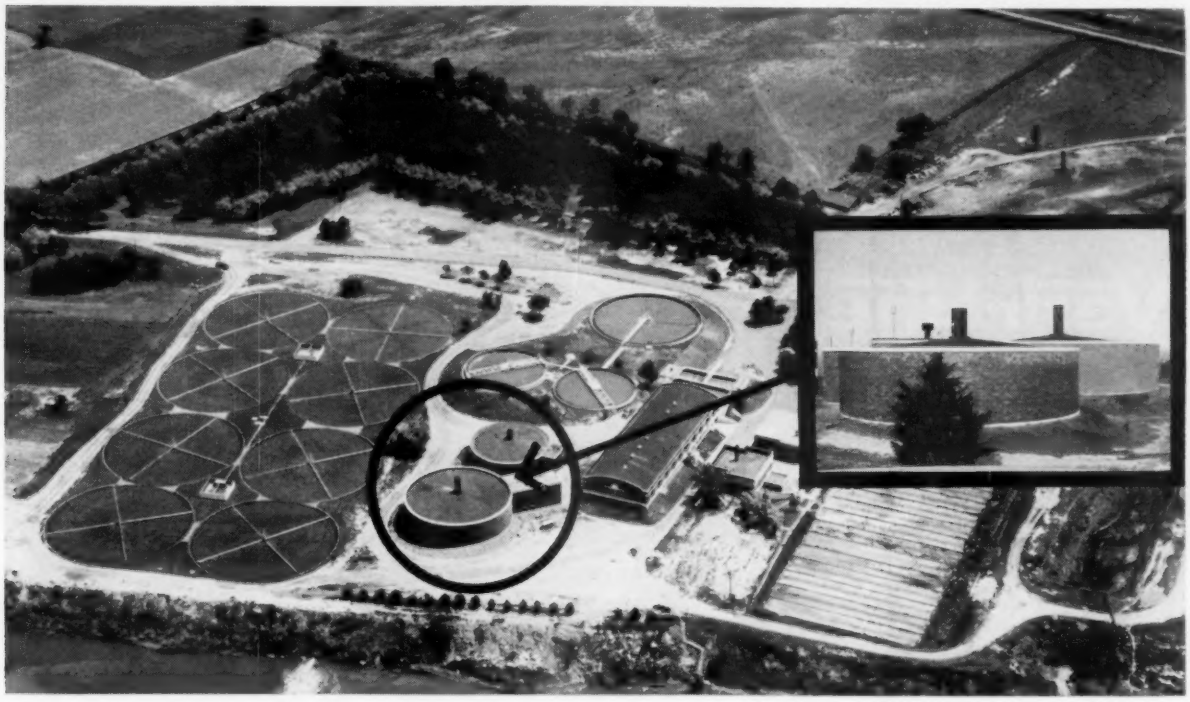
★ ★ ★

Swedefinition — Bills; something bigger in life than money.

★ ★ ★

More Council Bluffobia — Wendell LaDue, the Akron, Ohio, member of the Society of Council Bluffers keeps the secretary (V.T.Y.) informed of goings on in Council Bluffs from whence we derive our

Circled area shows 2 PFT Floating Covers—long building to the right contains 5 rectangular PFT Floating Covers



Lincoln, Nebraska continues modernizing

WITH PFT "CONTROLLED DIGESTION"

This unusual trickling filter plant at Lancaster Sanitary District #1 in Lincoln has undergone 3 major expansions in 18 years. It provides an excellent example of building for modern treatment on the base of full utilization of existing structures.

In its 1937 expansion, the District converted 5 small rectangular Imhoff Tanks into digesters, installing a *PFT Floating Cover* on each. Floating Covers were chosen for their positive scum submergence, flexibility of operation and safe utilization of gas.

Another digester was added in 1941 — a 65′ circular digester, again equipped with PFT Floating Cover along with PFT Gas Safety Equipment.

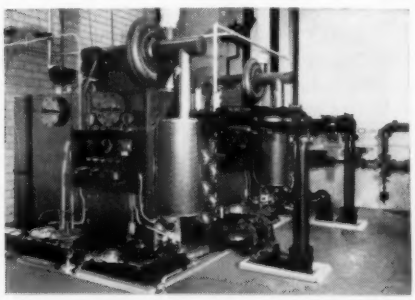
Lincoln's latest expansion came in 1953 when an 85′ diameter digester with PFT Floating Cover was installed.

In addition, a *PFT Heater & Heat Exchanger* unit was added (750,000 B.T.U. per hr.) for efficient and economical sludge heating. Fired by the sludge gas itself, the heater consumes the absolute minimum of purchased fuel.

A well planned gas safety system was also installed in 1955, including the following PFT equipment: Waste Gas Burners; Flame Trap; Pressure Relief with Flame Trap; Drip Taps; Auxiliary Flame Cell; Gas Check Valves; Gas Pressure Gauge.

Congratulations to Lincoln on making excellent use of older equipment in building a highly modern, efficient plant!

Design of plant by / *Black & Veatch, Consulting Engineers, Kansas City, Mo.*



PFT #750 Heater & Heat Exchanger — Gas-fired

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

Need more facts about advertised products? Mail your Readers' Service card now.

balanced design

Layne & Bowler engineers have designed the Verti-Line Turbine Pump to strike a balance between first cost and operating cost—to give the owner most for his pumping dollar for years and years.

balanced efficiency

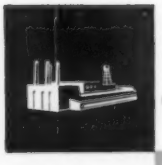
With a Verti-Line, you get sustained, high wire-to-water efficiency, plus wide efficiency spread for "off-peak" conditions . . . Efficiency which results from sound engineering and the highest possible standards of manufacturing quality control.

balanced operation

Better design and higher sustained efficiency combine to provide trouble-free performance and reasonable power costs far longer than conventional pumping equipment.

More than 100,000 satisfied vertical turbine pump users agree there's no pump like Verti-Line for low first cost, economical operation and negligible maintenance.

Whatever your pump needs, investigate Verti-Line Pumps, before you buy.



in all industry

on the farm

for the city

Send for your free copy of our new booklet, "Pumps for Sale." Ask for Bulletin U-55

Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY
general offices and main plant
2943 VAIL AVENUE • LOS ANGELES 22, CALIFORNIA

Need more facts about advertised products? Mail your Readers' Service card now.

club name. Recently, Council Bluffs' officers testing new radar auto speed checking equipment found that all autos were travelling only at 20 miles per hour.

On disassembling the meter, it was found that a bit of lint was blocking the needle.—Is the moral —if your water works instruments seem off, look for a bit of fluff?

★ ★ ★

Luminous Quote — "A detective with his murder mystery, a chemist seeking the structure of a new compound, uses little of the formal and logical modes of reasoning. Through a series of intuitions, surmises, fancies, they stumble on the right explanation and have a knack of seizing it when it once comes within reach."—Gilbert N. Lewis.

Not only the chemist but all researchers in any field, and that includes water and sewage, have that knack.

★ ★ ★

In the Illinois Digester, I read where the National Petro-Chemicals Corp. of Ficklin, Ill. has completed eight lagoons with a total water surface of 40 acres. These oxidation ponds are planned to provide polishing treatment of the waste effluent, when the receiving stream flow is negligible. They will also provide protection against damage to the stream in case of spills, leaks in the manufacturing area or failure of waste treatment units.

★ ★ ★

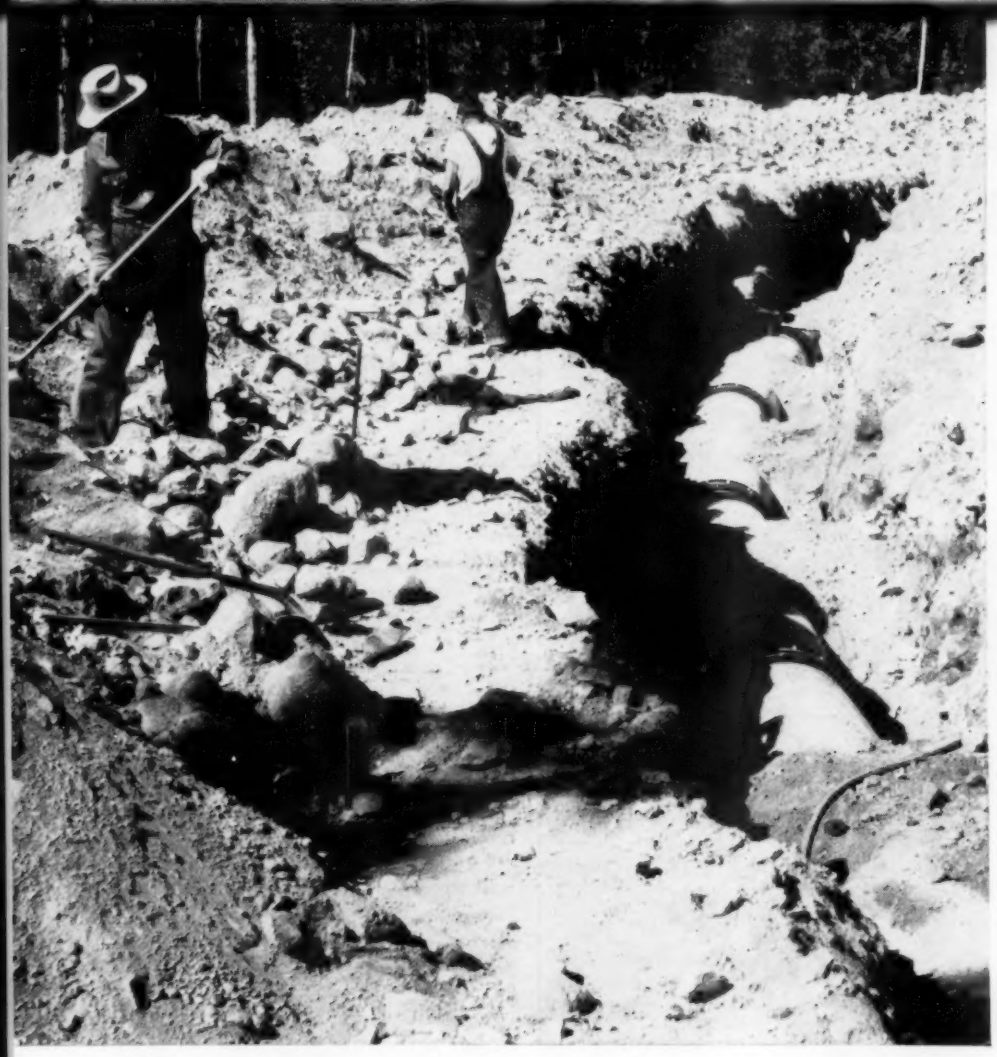
Jack Service, Advertising Manager of R. W. Sparling Co. writes, edits and produces the Sparling Metrogram and he does a wonderful job. Some time ago this statement appeared in the Metrogram, "The Hansgirg method of magnesium extraction results in metal that is 99.998% pure! Ivory Soap please note!"

Why, even sewage is purer than Ivory Soap's advertised 99 44/100ths with 1000 ppm of dissolved colloidal and suspended matter; sewage is still 99.90 per cent pure—water. Imagine! That small impurity is what we have to remove. No other industry can recover profitably from an ore so low in assay. For that matter we haven't learned how to make sewage treatment pay dividends, except in cleaner streams and better health.

★ ★ ★

I See Where: — The Canadian Section of AWWA and the Canadian

Need more facts about advertised products? Mail your Readers' Service card now.



DELIVERING WATER CHEAPER

DENVER, COLO.

As part of its Ranch Creek water collection system, the Denver Water Board laid 5,650′ of 30″ Dresser-Coupled steel pipe through rough, mountainous country. Both horizontal and vertical bends were encountered.

AURORA, COLO.

(Below) The City of Aurora tied into the Denver water system with a 12,978′ steel pressure main. Using Dresser Couplings, the contractor laid as many as 20 lengths of 36″ pipe in a 5-hour period.

Two Problems...One Answer

IN ROUGH OR EASY GOING DRESSER-COUPLED STEEL PIPE PROVES IDEAL

Adaptable to virtually *any* job conditions . . . that's one important reason why Water Board engineers are specifying steel water pipe joined with Dresser Couplings.

In addition, they are finding this modern "packaged pipe line" is easier to lay out, easier to install, more accurately predictable as to cost.

And costs are invariably lower because lighter weight steel pipe reduces installation time. Long, strong pipe lengths require fewer joints. Flexible rubber gaskets in Dresser Couplings permit the laying of curves with a minimum of shop-fabricated specials. Bottle-tight sealing makes leakage allowance for joints unnecessary.

Over and above these many advantages, Dresser-Coupled steel water lines are glass-smooth inside, sustain high carrying capacity. Virtually maintenance-free, they are today's most dependable way to *deliver water cheaper.*

√ *Wherever water flows—steel pipes it best!* Always put steel pipe and Dresser Couplings in your specifications.

DRESSER®

75TH ANNIVERSARY THE DRESSER WAY 1880-1955

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales offices also in: New York, Philadelphia, Chicago, Toronto.

SPECIAL PAINTING SYSTEMS FOR SEWAGE & WATER PLANTS

SENT FREE!

• Maintenance experts pooled their experience to bring you their best in maintenance painting methods, money-saving systems

Working together, maintenance men and paint experts condensed the results of their experience into a group of simplified, highly practical painting systems that meet all of your requirements. These surveys cover 267 types of equipment and surfaces, above and below water, tell you how to best protect against paint-destroying methanes, hydrogen sulfide, chlorine, lime, fungi, fumes, mildew and excessive humidity. These on-the-job reports can mean big improvements and savings in maintenance painting for you!

FREE! **Your business letterhead request brings free copies while available — write today!**

TROPICAL PAINT COMPANY • 1174-1248 W. 70th St., Cleveland 2, Ohio

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Institute on Sewage and Sanitation have opened a joint administrative office at 72 Grenville St. just a block from Dr. A. E. Berry's office in the Parliament Buildings. The new office is in charge of Mrs. Mae Grove as Executive Assistant. Bert Berry is Secretary of both organizations and Mae has been his right hand for many years.

★ ★ ★

News Notes from Brushy Bend—On March 28th the Long Island Water Conference met at Hennigsen Inn in Hicksville, L. I. This was "Hicksville Nite" and the special feature was a talk on "Water System Problems in Growing Communities" by W. T. Ingram, Consulting Engineer and Adjunct Professor at New York University.

. . . The Fourth Southern Municipal and Industrial Waste Conference was held at Duke University on March 31 to April 1. Theme of the meeting was "The Role of Water Resources in the Future of the South."

. . . April 1—The final meeting of the 1954-55 season of the North Jersey Water Conference was held at the Patterson YMCA. Dr. Thurlow Nelson, State Geologist spoke on ground water problems.

. . . April 13-15—A three-day "Conference on Biological Waste Treatment" was held at Manhattan College in New York City. W. W. Eckenfelder, Asst. Prof. (and consulting engineer-chemist) chairmaned the meeting which drew many interested persons including students from Mass. Inst. of Tech., Rutgers and New York University.

V.T.Y. — Doc Symons

Photogrammetry Useful in Highway Location

The development of Photogrammetry through aerial surveys is another outstanding help in the acquisition of rights of way. Our Division finds that with the use of such surveys, when the final alinement is settled and our agents are sent into the field, property owners are more inclined to find our offers just and fair. This may be due to the fact that they have not had several preliminary lines run through their gardens, lawns and fields. The intrusion of surveying parties upon private lands, even though they have a legal right to do so, causes the feeling that privacy has been invaded.—Maurice L. Schueler in Washington Department of Highways News.

DRESSER 1880-1955
well St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales offices also in: New York, Philadelphia, Chicago, Toronto.

for cleaning and developing water wells

WELTONE

the complete well cleaning preparation

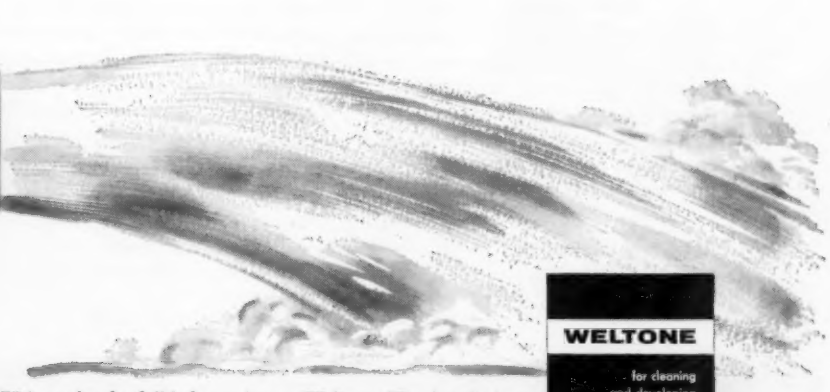
WELTONE is a complete well cleaning product that combines the exclusive dispersing action of Calgon* with several other chemicals into a highly soluble, effective powder.

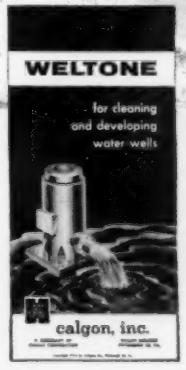
WELTONE IS SAFE . . . will not harm metals or concrete during the contact period, allowing cleaning with the pump in place. Weltone forms no dangerous fumes.

WELTONE IS EFFICIENT . . . at cleaning old wells or developing new wells. The high dispersive activity of Weltone effectively removes drilling muds, and the quartz, mica, silt and other materials which frequently prevent new wells from developing their full capacity.

WELTONE STERILIZES . . . and disinfects, destroying the growths of iron fixing or other bacteria which frequently contribute to lowered well capacities.

WELTONE IS EASY TO USE . . . specially processed to dissolve readily, Weltone may be added directly to the well in dry form. Use inexpensive Weltone to keep water wells at high capacity.





Write today for full information on Weltone. The descriptive folder is free, and contains complete information on the remarkable well cleaning properties of Weltone.

CALGON, Inc.

HAGAN BUILDING • PITTSBURGH 30, PA.

*Calgon is the registered trademark of Calgon, Inc., for its sodium phosphate glass (sodium hexametaphosphate) products.

Get full details of this month's products . . . mail your Readers' Service card today.

To meet the stepped-up needs of industry . . . .

ALLIS-CHALMERS PRESENTS TWO

ALLIS-CHALMERS

TS-360

280 HP

15-YD CAPACITY, STRUCK

20-YD CAPACITY, HEAPED

NEW BIG-YARDAGE WORK CAPACITY!

Power that pays

The TS-360's great new Allis-Chalmers engine spearheads a whole new power train that offers more rim pull at lower speeds for better loading, hauling and spreading performance; faster acceleration, easy shifting and quick getaways. Combined with new 20-yd capacity, this all adds up to fast, high-volume, high-profit work cycles.

New operating ease and safety

In addition to big-job power and gearing, the TS-360 Motor Scraper offers everything an operator needs to work easily, yet efficiently . . . new Double-Safety air brakes, new selective steering, direct electric starting, new multiple-disc cable control . . . and many others you'll want to know more about.

Strength to back it up!

The new TS-360 is built around a new, all-welded, heavy steel main frame that makes possible the service accessibility of unit construction. What's more, there's an all-new final-drive gear train, with new gears, shafts and bearings. These and many other advantages mean more work done, lower maintenance cost and longer equipment life.

Nowhere can you match these two in the amount of work they do!

Thousands use our Readers' Service card to keep up to date . . . do you?

. . . for more power—better performance—longer life . . .

NEW, POWERFUL DIRT MOVERS

ALLIS-CHALMERS

HD-21

204 NET ENGINE HP

44,000 LB

BIGGEST, MOST POWERFUL CRAWLER IN PRODUCTION . . . ANYWHERE!

New standards of output

The HD-21 introduces the new Allis-Chalmers engine and a great new power transmission team. Together, they provide extra speed with any load, extra pulling power at any speed . . . wider speed ranges and more range overlap. And with its advanced design torque converter (*the result of 15 years of leadership by Allis-Chalmers*) the HD-21 puts its power to work with less shifting than ever before possible . . . to help you reach a new high in efficient, profitable production!

New standards of durability

From the new Allis-Chalmers diesel with "follow-through" combustion to new, heavier Tru-Dimension track, the HD-21 is built to take today's big loads in stride, and come back for more. Here are just a few more of the long-life features you can't get from anyone but Allis-Chalmers . . . at any price: all-steel Box-A main frame, straddle-mounted final-drive gears, 1,000-hour truck wheel lubrication, oil-enclosed track release mechanism.

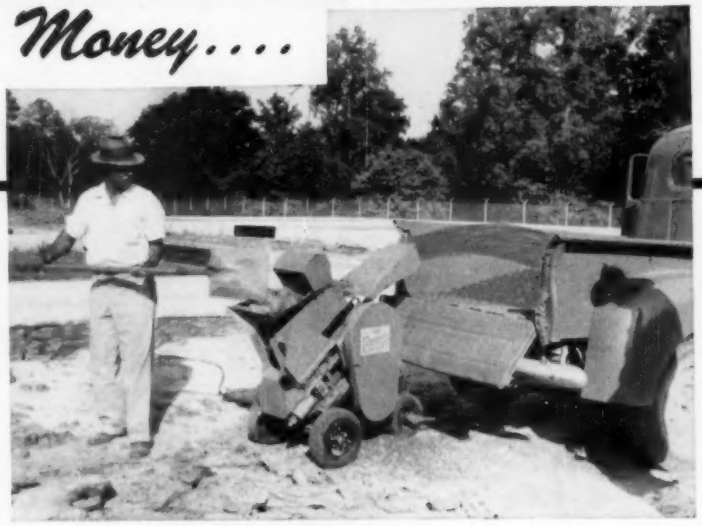
New low cost per unit of work

The HD-21 offers 20 percent greater over-all performance . . . provides a new measure of tractor value. Add the *planned* approach to service offered by Allis-Chalmers dealers, and it's the ideal team for men tackling today's big jobs.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Don't "BURN" Money.... "EARN" It!

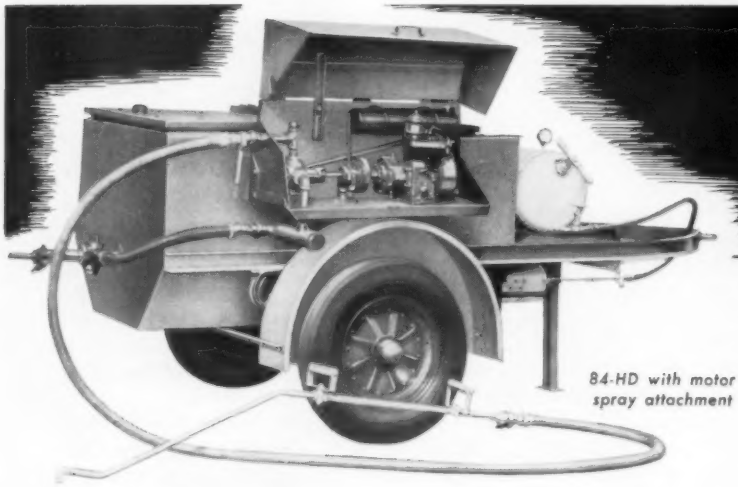


That's what they do in Decatur, Ga., where a Royer Shredder is busy converting sewage sludge cake into a saleable fertilizer. Instead of burning this valuable material, with the additional expense incurred by such an operation, this community is earning a steady income from a small investment in a Royer. Sludge cake, properly prepared for easy handling and application, has a ready market among florists, nurseries, golf clubs, gardeners . . . in fact, in any application where a good fertilizer is desired.

The operation of the Royer is simple . . . just feed material into the ample hopper and the machine does the rest . . . completely shredding and aerating the cake, removing all trash and discharging to bag, pile or truck. Made in capacities from 4 to 150 cubic yards per hour. Write for details.

ROYER foundry & machine co.
157 PRINGLE ST., KINGSTON, PA.

ROYER



84-HD with motor spray attachment

modern road repair demands LITTLEFORD

84 HD Tar and Asphalt Kettles

You get more "hot stuff" faster, at lower cost and with greater safety with the Littleford 84HD tar and asphalt kettles. Made in 3 models—standard, with hand spray attachment, and with motor spray attachment — there's a type for your requirements. For complete information on the most efficient kettle you can buy, send for Littleford bulletin X-1.

BLACK TOP ROAD MAINTENANCE EQUIPMENT LB SINCE - 1900 LITTLEFORD

LITTLEFORD BROS., INC.
452 E. Pearl St., Cincinnati 2, Ohio

Now's the time to mail this month's Readers' Service card.

The Fulfillment of a Promise . . .

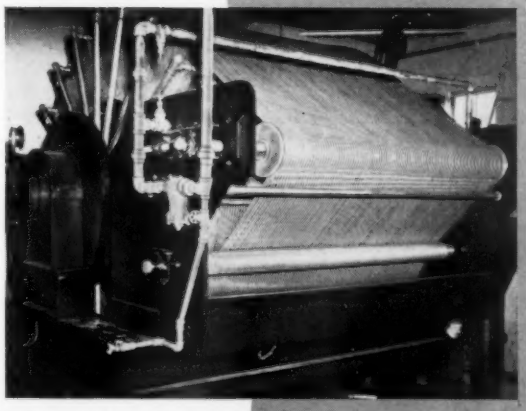
KOMLINE-SANDERSON COILFILTER

Sludge Vacuum Filters

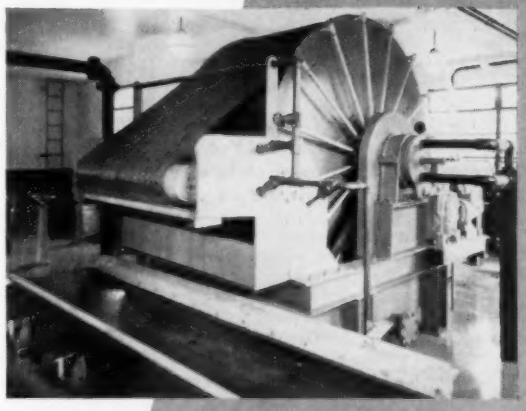
From its beginning in 1946, the development and ever-increasing acceptance of the KOMLINE-SANDERSON COILFILTER has meant the fulfillment of a promise. First: To those who conceived and put into being this significant step in modern sludge dewatering. Secondly: To the engineers and municipalities who have helped to prove the great efficiency and economy of these self-cleaning, rugged, high-output filters.

Starting with the first installation at Liberty, N. Y., in 1949, the acceptance of COILFILTERS has increased steadily, even spectacularly. In 1954 the number of COILFILTERS purchased for sewage sludge dewatering was more than five times the number of all other makes combined. Production facilities at our Peapack, N. J. plant have recently been quadrupled and plans are already being made for another expansion. The COILFILTER is indeed fulfilling its promise.

For more information, write for Bulletin No. 102.



1949 The first COILFILTER installation, a 150 sq. ft. unit for the dewatering of digested sludge at Liberty, New York.



1954 A 100 sq. ft. COILFILTER at Conshohocken, Penna. This unit replaced two 100 sq. ft. cloth-type filters.

KOMLINE-SANDERSON ENGINEERING CORPORATION

Peapack, New Jersey

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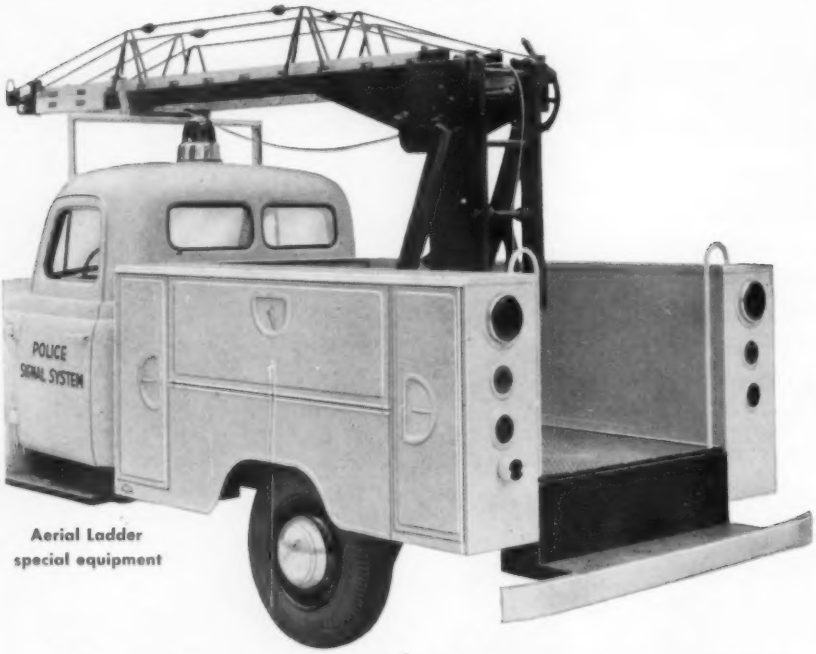

Aerial Ladder special equipment

● **Morrison's new Service Bodies and Accessories give your trucks a clean, neat appearance . . . provide maximum safety for crew and equipment . . . feature a compact design with more useable carrying space and a time-saving accessibility to tools, parts and supplies.**

With models to fit 40 different ½ - ¾ - 1 and 1½-ton, single or dual wheel chassis . . . 18 possible compartment arrangements . . . completely weatherproof compartments . . . and more than 20 other new design and construction features, Morrison Service Bodies are engineered and built to meet the specific service and maintenance requirements of all public works departments — street lighting, traffic control, water supply, roads and streets, airports, truck fleet maintenance, and any other type of general service work.

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In all phases of service and maintenance for public works, Morrison Service Bodies and Accessories can help you promote crew efficiency and cut operating costs. Complete information on the entire line is available on request.

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MORRISON STEEL PRODUCTS, INC. • 698 Amherst St. • Buffalo 7, N. Y.

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BOOKS IN BRIEF

FLOODS & WHY WE HAVE THEM

How floods start and gather momentum, the damage they inflict and what man can do to prevent them or protect himself against them is the subject of this book. The presentation is scientific, yet easily understandable and highly interesting. In view of current debates, the discussions of protection through dikes and levees and by reservoirs are timely. Nearly 150 pages are devoted to basin problems, projects and plans. There are nearly 100 pages on flood history, telling of historic floods, by streams, up to the present. William G. Hoyt and W. B. Langbein, the authors, are well-known scientists. Princeton University Press, Princeton, N. J.; 443 pages; $7.50.

WATER SUPPLY ENGINEERING

Any book by Harold Babbitt and Jim Doland is going to be good and this new Fifth Edition of their Water Supply Engineering is no exception. Starting with a discussion of water works hydraulics, it treats water demand and water sources, dams, intakes, aqueducts, reservoirs and pumping stations. Following pumps, valves, gates, hydrants and other water works appurtenances, the text goes into the design of distribution systems and water treatment, including coagulation and sedimentation, filtration, softening and disinfection. There are 551 pages, plus problems and many useful illustrations. McGraw-Hill Book Co., New York $8.50.

DRAINAGE AND CONSTRUCTION PRODUCTS

This is a new edition of one of the most valuable and useful technical books we know. It provides a technical treatment for the design and engineering application of many widely used drainage and construction products. It is an up-to-date version of the original text written by W. H. Spindler of Armco. In 10 sections and 64 well-written chapters it covers strength research; strength design; durability studies; economic factors; design principles and practices; subsurface drainage;

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TO VISIT BOOTHS 86, 87 AND 88 AT THE SEVENTY-FIFTH ANNUAL CONVENTION OF THE AMERICAN WATER WORKS ASSOCIATION — JUNE 12TH. THROUGH JUNE 17TH.

REPRESENTATIVE ITEMS OF THE COMPLETE LINE OF WATER WORKS EQUIPMENT, SUPPLIES AND SPECIALTIES OFFERED BY MUELLER CO. WILL BE ON EXHIBIT.

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Thousands use our Readers' Service card to keep up to date . . . do you?

Saves 6 men, 4 tampers, 2 compressors and small dozer with one-man-operated "80-W"

VAN DOREN BROTHERS of Richmond, Virginia recently backfilled and compacted approximately two miles of trench, 2 feet wide and 4 feet deep, for a 6-inch gas line with just one man and one machine, a Cleveland "80-W" backfiller.

Before the Van Dorens purchased their "80-W" they used 7 men, a rubber-tired dozer, 2 compressors and 4 air-driven tampers for backfilling and compacting on jobs of similar size and type. The one-man-operated "80-W" did the complete job in less time than the 7-man crew formerly required on comparable jobs. "It's a great time saver," was F. M. Van Doren's comment on its performance.

On a previous job their Cleveland backfiller had saved them considerable time and money on a 12-inch water line trench, averaging approximately 6 feet deep, by its unique ability to backfill spoil deposited on a down slope on the far side of the trench, while simultaneously tamping it to the state of Virginia's rigid compaction specifications.

The "80-W" also does an outstanding job of side-crane work, lays pipe, pulls crossings, sets hydrants and valves, pulls sheathing, loads and unloads pipe, etc. Despite its ability to perform all these operations—and do an outstanding job on *each* of them—the "80-W" is easy to operate. The Van Dorens' operator learned to operate it with high efficiency after only two days training on the job.

Investigate this remarkable time, labor and machinery saving tool now—so that you, too, can realize its outstanding benefits on your next job.

See your local distributor for the full Cleveland story or write direct to:

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

Now's the time to mail this month's Readers' Service card.

special drainage problems; and miscellaneous and installation data. There are many useful and excellent tables, an appendix summarizing research on underground conduits and a well-organized index. As an example, the section on Design Principles and Practice deals with: Hydrology, the design of open channels; the theory of critical flow; the design of culverts or cross-drains for size; culvert location and length; highway surface drainage; design of sewers for size; hydraulics of sewers; etc. Published by Armco Drainage & Metal Products, Inc., Middletown, O. 592 pages; 380 illustrations; $5.

FIELD SERVICE SAFETY MANUAL

This Manual was prepared cooperatively by the field service departments and Industrial Relations Division of Allis-Chalmers Co., and includes breakdowns on many standard operations in the form of safe practice and data sheets; it can be used as a training vehicle for those who have to fit new men into assignments and who are responsible, in a measure, for their safety. 73 pages. Copies free from Allis-Chalmers Manufacturing Co., Industrial Press, General Machinery Div., Milwaukee 1, Wis.

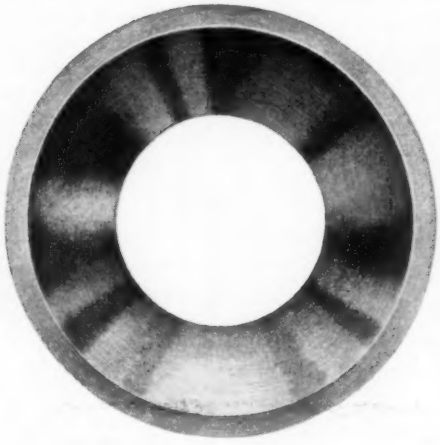
PERSONAL NEWS

Julian R. Fleming has been appointed Director of the Division of Sanitary Engineering of the Tennessee State Department of Health. He succeeds R. P. Farrell, victim last winter of a drowning accident. Mr. Fleming has had an excellent experience in sanitary engineering, including teaching and consulting work. He has been Associate Professor in charge of Hydraulic and Sanitary Engineering at the University of Tennessee since 1946.

James M. Brown, well known to most sanitary engineers in the east, has been appointed Superintendent of the New Rochelle (N. Y.) Sanitary District Sewage Treatment Plant. He will supervise the start-up and operation of this new plant and will assist the Westchester Department of Public Works, which has supervision over it, in other matters pertaining to sanitary engineering. Jim Brown has been with the Lederle Laboratories Division of American Cyanamid Co. During the war he served in the Army Sanitary Corps.

"Century" Pipe, 4" Class 150, ready for laying in trench in Oakland, Oklahoma.

SMOOTH BORE



"CENTURY"® PIPE

The smooth bore of "Century" Asbestos-Cement Pipe means less resistance to water flow and, consequently, lower pumping costs. Formed on a smooth steel mandrel, the pipe has an interior surface to match. The Williams and Hazen Constant "C" is conservatively placed at 140 for "Century" Asbestos-Cement Pipe. Being non-metallic, it cannot tuberculate.

More and more cost and tax conscious communities are recognizing the economy of "Century" Pipe. We will gladly furnish information about its advantages. Write today for a copy of our free booklet, "Mains Without Maintenance."

QUALITIES THAT MAKE "CENTURY" PIPE ECONOMICAL, TROUBLE-FREE, LONG-LIVED

1. NON-TUBERCULATING
2. NON-CORROSIVE
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4. DURABLE
5. IMMUNE TO ELECTROLYSIS
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8. EASILY, QUICKLY LAID
9. LIGHT WEIGHT
10. LOW COST

"Century" Pipe meets the A.W.W.A., A.S.T.M. and Federal Specifications for asbestos-cement pressure pipe.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos ®

Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

Now's the time to mail this month's Readers' Service card.

Self Propelled Mark-Rite Tandem Liner, Model 8088 with reflecting bead hopper shown, available with single or double line attachment.

DOWN THE ROAD A PIECE... OR BEFORE you buy,

- one way or another you find out about line marking equipment.
- Look for the vertical paint tank, independent from air reservoir; we don't use the horizontal type even though it's cheaper, because the paint might back up into the compressor.
- A large quick-release tank opening is a must for rapid reloading and the whole tank must be removable for easy cleaning.
- Make sure you get ample compressor capacity. Mark-Rite units have a generous reserve of horsepower and air.
- Check the location of the gun; it should be at the pivot point to maintain line width on turns. Can it paint cross walks right up to the curb? Ours can.
- See that you get an automatic type gun (we use the best that is made by the largest manufacturer of road striping guns), and don't overlook the strainer.
- Size up your work load, we have the greatest selection, from small push types to large self-propelled sizes of road marking equipment, and can steer you rite.
- Mark-Rite liners will handle all types of road marking paint including reflective pre-mix or binders for drop-on beads. They can be connected quickly to standard spray gun for stencil work, fire hydrants, benches, etc.
- It all adds up to a greater economy in your entire road marking program. There are over 19,000 satisfied users to confirm it.
- Get in touch with your local supply house or write to the factory and ask for a demonstration.

Mark-Rite ECONO-LINER

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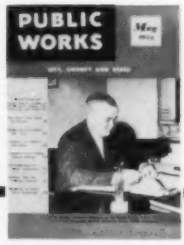


LEADERS IN PUBLIC WORKS

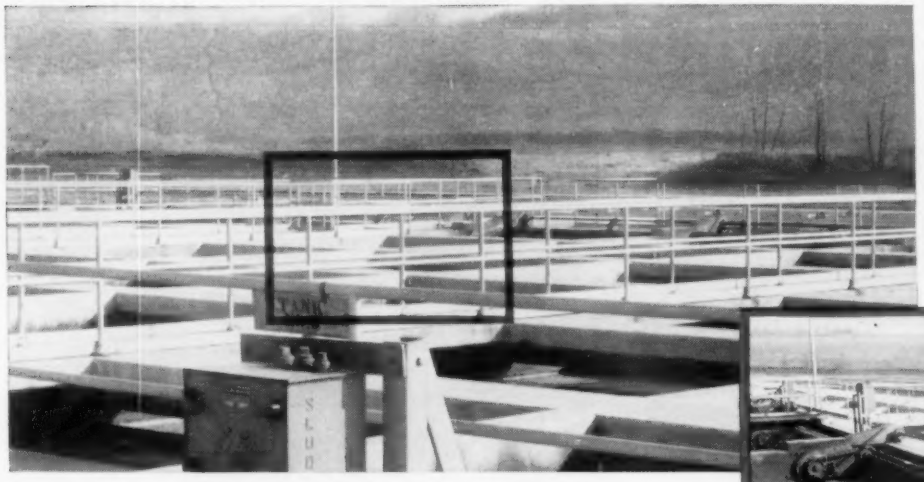
★

Olney Borden is a consulting engineer with his home and offices in Liberty, N. Y., up in the Catskill Mountains. He confines his practice to that part of the country; and since all of the communities are small, he does few large jobs; but he does engineer small jobs — the kind that makes one proud to know engineers and to be one. He specializes in sewage treatment, sewerage and water works, but also handles incinerators, street work and swimming pools. In addition to being retained by most of the villages in his area, he has served as engineer for many of the famous hotels in Sullivan County, such as the Grossinger, which is really a village in itself, with a population up to 1500.

He was graduated from Syracuse University with a BSCE degree in 1930 and immediately started engineering work in the area where he was born and now lives. He took out four years, 1942 to 1946, to serve in the Sanitary Corps of the Army, leaving the service with the rank of Major.

He is a registered professional engineer and a member of ASCE, AWWA and FSIWA, serving on the Executive Committee of the New York Association of the latter. He is a Mason, a Rotarian, a volunteer fireman, a Trustee of the Presbyterian Church and a member of the American Legion. He played basketball and baseball for many years; now it is bowling (175 average) and deer and ruffled grouse hunting. He and Mrs. Borden have one daughter, Ardith, who is now in college.

CLEVELAND Chooses REX®



Cleveland Southerly Sewage Treatment Plant. Havens and Emerson, Consulting Engineers, W. E. Gerdel, Superintendent.

18 power driven chain and scraper skimmers.

Six primary tanks 50′ wide x 126′ long.

OVER 2500 REX CONVEYOR SLUDGE COLLECTORS IN OVER 750 CITIES AND INDUSTRIES...

WHAT BETTER PROOF OF REX SUPERIORITY?

Yes, over 750 cities and industries rely on Rex® Conveyor Sludge Collectors for efficient, dependable and economical operation. These precision-engineered sludge collectors are applicable for all types of sludge-handling or surface-skimming conditions in either sewage, water or industrial waste treatment application...no application is too large or too small...and each receives the full benefit of Rex Engineering.

Here are some of the outstanding time-proven features of Rex Sludge Collectors.

- Balanced Equipment Design—design proportionate throughout.
- Rex Z-Metal Chain and Attachments—corrosion and wear resistant.
- Self-Aligning Bearings—easy to install. Compensate for tank irregularities...prevent accumulation of settled solids.
- Offset Split Drive Sprockets—eliminate bulky cantilevered brackets. Easy to replace.
- Centralized, Hardened Wearing Shoes—eliminate splitting strains on wooden scraper flights. Means longer life, lower maintenance.
- Double-Life Sprockets—chain engages only every other sprocket tooth.
- Drive Unit—compact, totally enclosed. Shear pin protection. Jaw clutches provided where independent operation is required.
- Sub-Assemblies—shop assembly of drive units and shaft assemblies assure proper alignment and fit.

MAKE SURE YOU WILL BE THE NEXT ONE to profit from Rex Design and Rex Quality. Get all the facts on Rex Conveyor Sludge Collectors. Call your nearest Rex Sanitation Engineer or write for Bulletin 49-9. Chain Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.

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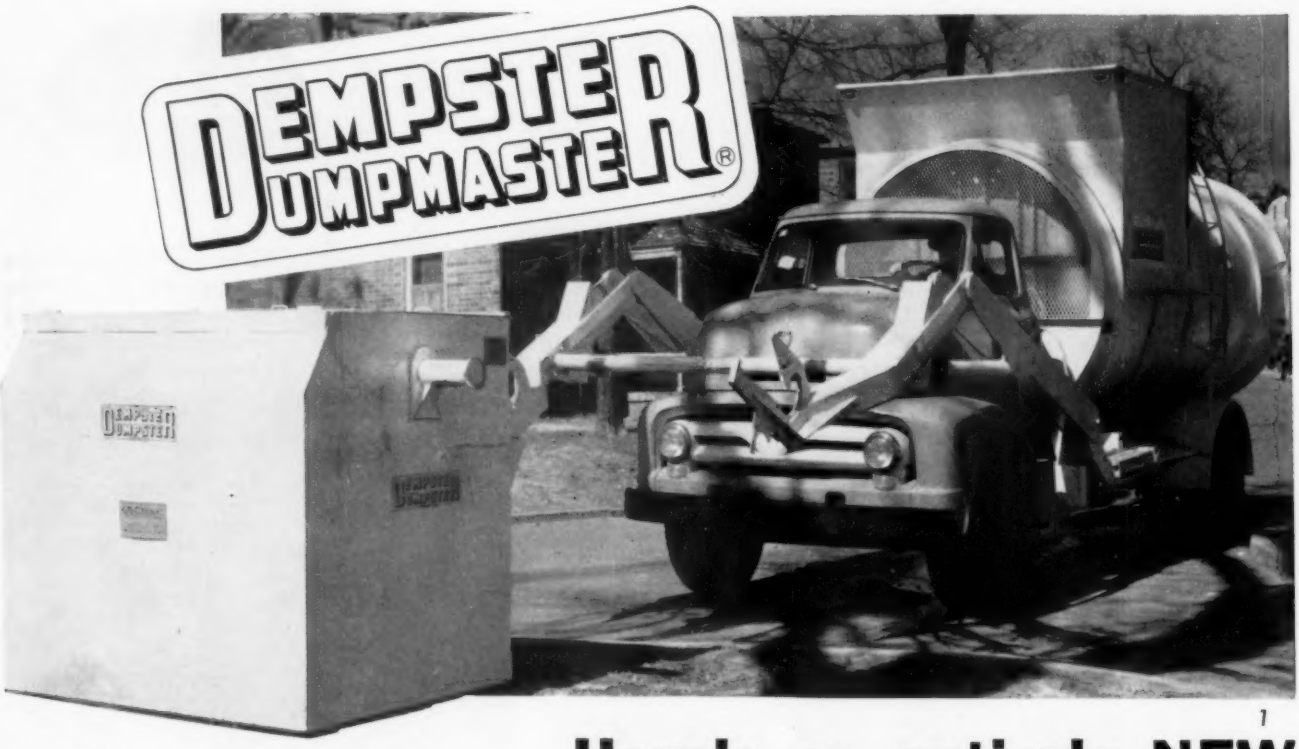


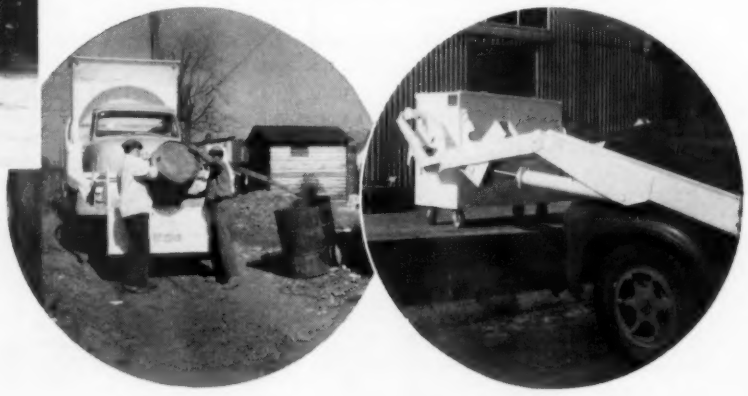
1

BEFORE AND AFTER scenes below, photographed in Asheville, N. C., represent typical conditions where unsanitary, costly conventional handling of refuse were corrected with the modern, low cost Dempster-Dumpmaster and its detachable containers.

Here's an entirely NEW for any City or Town

THE FLEXIBILITY of the Dempster-Dumpmaster includes safe front-end collection of refuse from conventional cans in alley pickup. Men are always in safe area in full sight of driver. Containers may be handled from most any platform height, as shown in second photo at right.

IT'S THE LATEST development in the family of Dempster-Dumpster equipment for low cost handling of refuse. A glance at the pictures and one immediately realizes this Dempster-Dumpmaster is the natural solution to the great majority of costly and, unsanitary methods of refuse collection where containers of limited capacity are preferred. Here's why: (1) The Dempster-Dumpmaster Detachable Containers always remain at the accumulation point. (2) Three sizes—1¼, 2 and 3 cu. yds. capacities—are available to meet every requirement for frequent pickup. (3) Containers may be placed in or outside of build-



WITH THE DEMPSTER-DUMPSTER SYSTEM for collection of refuse in 6 to 15 cu. yd. containers and the new Dempster-Dumpmaster for collection in 1¼, 2 and 3 cu. yd. containers, your city can now further eliminate costly re-handling of refuse and unsanitary conditions caused by the use of inadequate conventional cans, open crates, boxes, etc. Like the larger capacity containers, those used with the Dempster-Dumpmaster are furnished with hinged lids, which are easily opened by user when deposits are made, then closed, sealing up the refuse—eliminating fire hazards, odors, rats and the scattering of trash and rubbish by winds and scavengers. When filled, they are emptied mechanically direct into compaction body for maximum capacity hauling. The simple action of the Dempster-Dumpmaster is shown in Photos 1, 2, 3 and 4. It serves one detachable container after another. Casters may be supplied on any container for easy movement to and from pickup point. 1½ cu. yd. open front container is available for alley pickup collection of residential refuse.

2

3

Revolutionary Method of Refuse Collection regardless of size

4

ings—caster equipped 1¼ cu. yd. containers, for instance, pass through single doorways into office buildings, stores, cafeterias, etc. (4) Only one man, the driver, is required and he never has to leave operator's seat. (5) By picking up loaded refuse at front end of truck, driver has complete vision of the entire operation when Dempster-Dumpmaster is being used for collection of refuse from conventional cans in alleys, etc. (6) Hydraulically operated Dempster-Dumpmaster picks up each container and dumps refuse in the compaction type body for maximum capacity loads. (7) No equipment approaches the flexibility of the Dempster-Dumpmaster for general service, particularly in the smaller cities.

The Dempster-Dumpmaster is now available with compaction type body of 20 cu. yd. capacity, mounted on any make truck chassis of suitable size. Write us today for complete information. Dempster Brothers, Inc.

DEMPSTER BROTHERS
955 Dempster Bldg. Knoxville 17, Tennessee

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NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

What You Should Know About Pipe Detectors

94. A new, up-to-date operating manual for pipe detecting instruments has been made available by the Detectron Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make pipe detector. To get a copy just check the coupon.

Have You Investigated Fiberglass for Signs?

98. Outstanding features of fiberglass "Dura-Signs" include long life, high tensile strength, easy installation, corrosion resistance and low cost. Blanks and lettered signs are available for every highway need. Get latest data by checking the coupon or write Perry Plastics, Erie, Pa.

Better Highways Through Salt-Soil Stabilization

123. Shoulder stabilization is the subject of a new booklet in the series of informative pamphlets issued by International Salt Co., Inc., Scranton, Pa. Step-by-step illustrations show construction procedures in detail. For practical information on this important subject check the coupon today.

New Developments in Municipal Incineration

141. Continuous flow, controlled incineration of municipal and industrial wastes is outlined in Bulletin 10-54 of Combustors, Inc., 80 Boylston St., Boston 16, Mass. Longitudinal section of building showing equipment in a typical installation is included in the bulletin. Check the coupon for your copy.

Comprehensive Data on Bulldozers

232. Hydraulic Bullgrader and bulldozer blades for International crawler tractors are described in a 24-page catalog published by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. All features are fully described, complete specifications are included and many illustrations show on-the-job operations. Check the coupon for your copy.

Equipment for Waste and Water Conditioning Processes

240. Equipment for conditioning of municipal and industrial water and treatment of industrial wastes is discussed in Bulletin WC-117, issued by Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. For your copy check the coupon or write direct to the manufacturer.

Engineering Data on The Spiraflo Clarifier

366. Helpful engineering data on the Spiraflo clarifier are presented in 8-page Bulletin 6791 by Yeomans Brothers Co., 1999 N. Ruby St., Melrose Park, Ill. Details on operation of the unit, performance data, typical plan and elevation, detention time curve and mechanical specifications are included in this useful publication. To get your copy just check the coupon.

Effective Sweeping for Cleaner Streets

421. Outstanding features of Wayne Model 450 Sweepers are described in an attractive folder which covers operating advantages and general specifications. Data on dual control models are included. For your copy write Wayne Mfg. Co., Pomona, Calif., or check the coupon.

Easily Cleaned, Long Run Filter Bed Media

424. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

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411. Be sure to investigate the "Pak-Fine", a hand-carried portable 2-way radio for communication during emergencies and better coordination of extensive construction work. Powered by internal batteries, 6 volt or 117 volt supplies. Descriptive literature gives details of several models, shows applications. Check coupon or write Industrial Radio Corp., 428 N. Parkside Ave., Chicago 44, Ill.

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412. A comprehensive bulletin on Sealtight paving products is now available from W. R. Meadows, Inc., Elgin, Ill. Specifications and data are included on physical properties, dimensions and installation of asphalt expansion joints, corkfill expansion joints, fibre expansion joints, center strip, dummy joints, concrete curing compounds, subgrade paper, base plate, rubber asphalt joint seal, sewer joint compounds and road marking paints. Check the coupon for your copy.

What You Should Know About Meter Setting and Testing Equipment

413. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All water works men concerned with setting and testing meters will want a copy of this catalog, No. 56. Check the coupon for your copy.

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park-picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the coupon today.

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415. "Ureabor" weed and grass killer completely destroys vegetation about fence lines, parking lots, storage areas and similar places. Ease of application and maximum long-lasting results make this material the choice where a nonselective herbicide is required. For latest data write Pacific Coast Borax Co., 630 Shotto Pl., Los Angeles 5, Calif. or check the coupon.

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Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the coupon for your copy.

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NOT GOOD AFTER JUNE 15, 1955 MAIL THIS CARD NOW

The Super 55 offers diesel or gasoline engine. Equipment shown is Oliver No. 27 side-mounted mower.

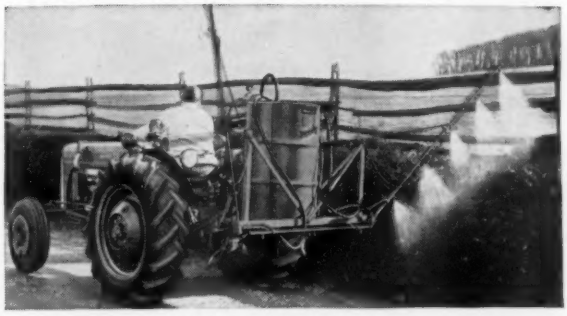
In features, versatility... OLIVER SUPER 55 is years ahead!

From every angle, this new Oliver is years ahead in power, flexibility, handling ease and utility than any tractor of comparable size!

Only the Super 55 gives you a choice of two engines —diesel or gasoline. You pick the one that fits your work the best, saves the most. You pick the equipment you want, too—3-point hitch, front or side mounted. Built-in hydraulics operate all three types.

The Super 55 is low and compact, built to the size that lets you work anywhere. Its light-handling ball-type steering and double-disc brakes make maneuvering in tight quarters easy. And with six forward speeds —five working speeds, one road speed—you select the gear for each job, do more on less fuel than ever before.

You'll be surprised at the low price of this years-ahead tractor. Why not try the Super 55 yourself? Phone or visit your Oliver Industrial Distributor for a demonstration.



Here is the Super 55 with 3-point hitch Oliver Iron Age weed sprayer. Oliver also offers many other mounted and pull-type sprayers.

3-point hitch scraper operates from built-in hydraulic system. 1000 pound front loader is controlled from front-mounted hydraulic pump.

THE **OLIVER** CORPORATION
400 West Madison Street, Chicago 6, Illinois

OLIVER

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To order these helpful booklets check the coupon on page 32.

Diatomite Filtration of Potable Water

407. The use of diatomite filtration for municipal water supply and swimming pool water treatment is the subject of a 16-page bulletin issued by the Dicalite Div., Great Lakes Carbon Corp., 18 East 48th St., New York 17, N. Y. Details are furnished on the use of diatomite in filtration, cost and efficiency, design data and results of typical installations. To get this bulletin, No. F-552, check the handy coupon.

What is Happening to Highway Mowing?

408. In a new, informative booklet Triumph Machinery Co., Hackettstown, N. J., discusses the problems presented to State, County and City highway officials by modern traffic conditions and the demand for increased mowing efficiency. Check the coupon to get your copy and review the basic requirements for good results in mower operation.

Protective Lining for Concrete Pipe and Structures

409. T-Lock Amer-Plate is a tough, long-lasting acid-resistant lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Div., American Pipe and Construction Co., South Gate, Calif., or check the coupon for illustrated folder.

How Counties Benefit By Motor Grader Investments

418. County commissioners tell how they have invested taxpayers' money in equipment for highway maintenance, and report savings from these investments in the booklet "Caterpillar Motor Graders—An Investment of Taxpayers' Money," published by Caterpillar Tractor Co., Peoria 9, Ill. For a copy of this booklet, Form D518, check the coupon.

Design and Applications of the Spiragester

419. The Spiragester is a combination of a clarifier and a digester in a single unit, compactly arranged for economical construction and ease of operation. Full data on operation, explicit design information and specifications are included in Bulletin 135, issued by Lakeside Engineering Corp., 222 West Adams, Chicago, Ill. Check the coupon for a copy.

Chemicals Regulate Growth of Grass

420. To retard the growth of grass on highway shoulders and other areas where mowing is a heavy maintenance expense the use of a chemical, MH-40, is suggested by Naugatuck Chemical Div., Naugatuck, Conn. Full details on application and typical results are provided in Bulletin No. 17, available by checking the coupon.

Blastcrete Equipment for Concrete Placement

410. The Blastcrete gun places 1 to 5 cu yds. per hour for construction, lining and repair of all types of structures. Rate of material flow is easily adjusted while machine is in operation. Handles materials either dry or up to 60% moisture. For full details check coupon or write Blastcrete Equipment Co., Inc., 11154 Santa Monica Blvd., Los Angeles 25, Calif.

New Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs fo rtraffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave. S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs. Check the coupon.

Painting Manual for Sewage Disposal Plants

423. A handy paint guide for maintenance of sewage disposal plant structures is offered by General Paint Corp., Box 3474, Rincon Annex, San Francisco 19, Calif. Recommendations for various types of surfaces, painting preparations and specifications for application and coverage are all included in comprehensive Bulletin 5406. Check the coupon for a copy.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter", which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the coupon today.

How to Eliminate Seepage On Construction Projects

426. Labyrinth waterstops are easily installed to provide the answer to the seepage problem and simplify form work on all types of construction jobs. Investigate their use for water and sewage plants, reservoirs, swimming pools, etc. For full data check the coupon or write to Water Seals, Inc., 9 So. Clinton St., Chicago 6, Ill.

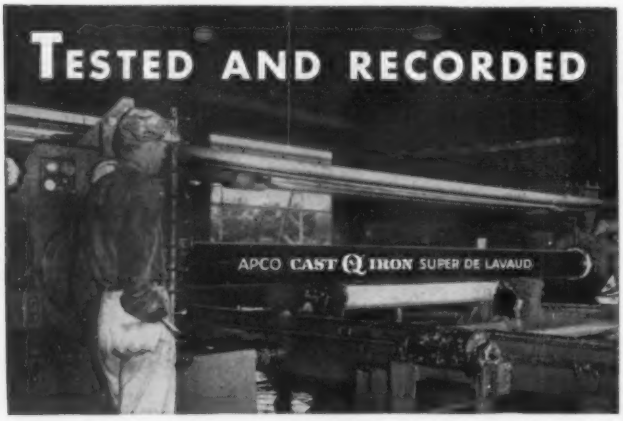
For Prompt Service Use The Coupon

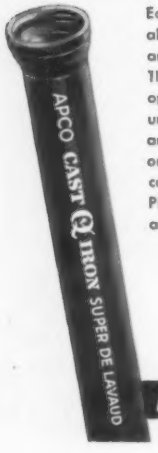
How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs. Check coupon for your copies.

Solids Pump Uses Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details, get Bulletin SP-10 by writing to Western Machinery Co., 76 Folsom St., San Francisco, Calif., or check the coupon.





Each length of pipe we manufacture passes through the above hydrostatic test press where it is filled with water and the pressure raised to 500 pounds per square inch. The most common water works pipe is designed for an operating pressure of 150 pounds per square inch. This undergoes the 500 pounds per square inch hydrostatic test and permanent records for each piece of pipe are kept on file for inspection by our customers at all times. You can be assured with Alabama's Super De Lavaud Cast Iron Pipe. In sizes of 3" to 24" in modern long lengths. Bell and Spigot, Mechanical Joint and Flanged Pipe.

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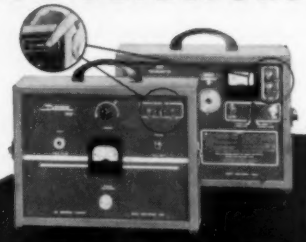

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But... Do They Have ALL These "505" Features

1. ALUMINUM CASE shields the loops from outside interference and is light — durable — repairable.
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Also Available: Model 505-C Combination Pipe-Leak Detector

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Tractor mounted. New claw-action feeder with automatic release. Ten-foot discharge height. Eight-foot boom overhang. Self-propelled at 10 m.p.h.

LOAD economically with the new Barber-Greene 550 Windrow Loader.

LOAD rapidly up to 4 cu. yds. per min. of earth, sand, loam or similar material, even leaves, or load snow up to 7 cu. yds. per min.

LOAD continuously at capacities that keep ahead of all trucks normally available.

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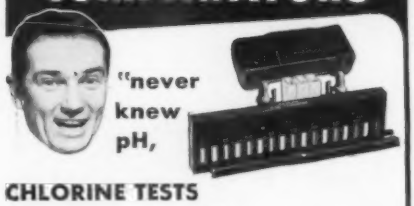

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Dustproofing Roads with Calcium Chloride

429. Elimination of dusty road problems, reduction of aggregate loss and savings on road blading operations are discussed in the bulletin "Wyandotte Calcium Chloride for Dustproofing." Also included are helpful data on quantities required for many types of surfaces. Write Wyandotte Chemicals Corp., Wyandotte, Mich., or check coupon for a copy.

Introducing Street Lighting Needs to the Public

430. To help municipal officials demonstrate the importance of adequate, modern street lighting to the citizens of their community, General Electric Company has released a 26-minute motion picture which dramatically illustrates the relation of street lighting to traffic safety and crime reduction. Entitled "Out of Darkness," the film vividly documents how one community faced and solved the problem of inadequate street lighting. "Out of Darkness" is available on a one-time loan basis through General Electric Apparatus Sales Offices. For more details write General Electric Co., Schenectady, N. Y. or check the coupon.

●

WATER WORKS

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., Box 3277, Los Angeles 54, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the coupon for your copy, or write for Bulletin 314.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves are contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., Eliot Street, Fairfield Conn.

Specs for Gate Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Vertical Turbine Pumps For Municipal Water Supply

121. Engineering data on vertical turbine pumps for deep or shallow well operation in capacities ranging from 50 to 10,000 gallons per minute, oil or water lubricated, are covered in a booklet issued by Worthington Corp., Vertical Turbine Division, Succasunna, N. J. Check the coupon today for this helpful information.

Helpful Data on Sluice Gates

158. In a well-organized 48-page catalog you will find complete engineering and design data on Pekrul sluice gates, headgates, automatic flap gates, lifts and accessories. Numerous models in 6" to 92" sizes are available, and all pertinent data will be found in this helpful booklet. Write Morse Bros. Machinery Co., Denver, Colo., or use the coupon.

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STANDARDS

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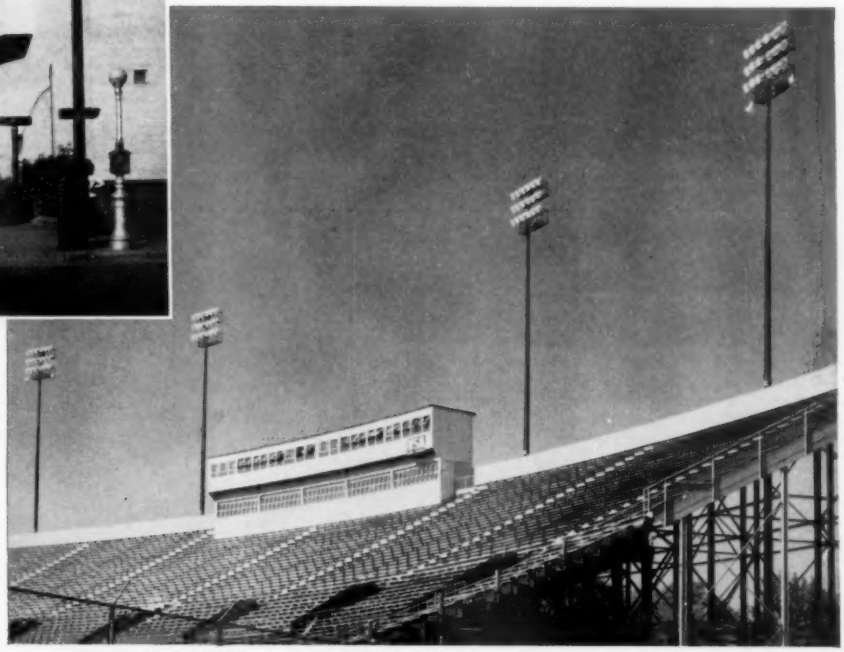
Kerrigan standards line San Jacinto Street, Houston, Texas. Looking North at the new County Court House.



Four of eight standards used to light Vanderbilt University's football stadium. Kerrigan 1400K, octagonal, continuous tapered standards, some as tall as 120 feet. Tallest in the Southeast. Each standard made in two sections and fabricated from high strength, J & L'S Jalten corrosion resistant steel. Each complete with flood mounting and service platforms made of Kerrigan grating. Each standard supports a battery of 18 flood lamps of 20,000 lumens, and is designed to withstand over 100 miles an hour wind pressures.

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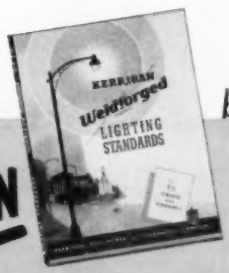
for new catalog containing detailed descriptions and specifications.



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For better lighted city streets the standard is Kerrigan!

KERRIGAN IRON WORKS, INC.

NASHVILLE, TENNESSEE

General Sales Office 274 Madison Ave. New York City

Now's the time to mail this month's Readers' Service card.

To order these helpful booklets check the coupon on page 32.

Helpful Data on Water Works Products

49. A completely new catalog covering the entire line of water distribution and service products offered by the Mueller Company, of Decatur Ill., is now available to engineers and water works superintendents. The 328-page catalog features an easy-to-use sectional indexing arrangement to facilitate quick reference to any of the hundreds of products listed. A large section of useful engineering information is included Check the coupon today.

What You Should Know About Turbine Pumps

167. In a colorful bulletin titled "Water Where You Want It . . . When You Want It" the Johnston Pump Co., Bin "K", Pasadena 8, Calif., gives details on turbine pumps with semi-open or closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of Bulletin 1015 by checking the coupon.

Pipe Joint Essentials and Couplings for Every Job

168. Superior pipe joints are tight, flexible, simple, strong and economical. Dresser's handsome 34-page bulletin No. 513 shows how these essentials are met and provides layouts for curves, working pressures and a wealth of other data. Be sure to check this bulletin on the coupon. Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

Couple Pumps and Where to Use Them

194. Turbine pumps, coupled to motors or gear drives, offer many arrangements to suit your pumping needs. Mechanical features, capacity curves and service applications are reviewed in Bulletin C of Layne & Bowler Pump Co., Box 6991, Los Angeles 22, Calif. Check the coupon for your copy.

Precision Line Locator Speeds Maintenance Work

202. Accurate location of buried pipe and cable is made easy with the compact, all-purpose Wilkinson Line Locator, made by Wilkinson Products Co., 3987 Chevy Chase Dr., Pasadena 3, Calif. One-man instrument finds depth as well as location, saves "guesswork" excavations. Get latest data by checking the coupon.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

Helpful Data On Pipe Tools

230. Toledo drop head ratchet threaders are light, compact, ideally suited for work in tight corners. Three models for ⅛" to ¾"; ⅛" to 1¼"; and ½" to 2" pipe all feature quick change of sizes. Get Catalog No. 25 from Toledo Pipe Threading Machine Co., Toledo Ohio. Check the coupon.

Explaining the Water Diaphragm Principle of Chlorinator Operation

243. The features, operation and benefits of the water diaphragm principle of chlorinator operation are fully described and illustrated in Publication TA-1026-C-1 recently published by Wallace & Tiernan Inc., Belleville 9, N. J. This helpful publication is yours for merely checking the coupon.

Water Conditioning Data Book Offered To Engineers

259. All engineers and municipal officials concerned with water conditioning will want a copy of the greatly enlarged edition of the popular Permutit Data Book prepared by the Permutit Co., 330 West 42nd St., New York 36, N. Y. This completely revised book presents a compilation of 78 tables, all valuable to the engineer. Subjects include hydraulics, impurities in water, reactions and conversions of chemicals used in water treatment, alkalinity relationships and other helpful material.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. Get full details by checking the coupon. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Coraopolis, Pa. Check the coupon for your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the coupon.

Cleaning Service for Every Type of Pipe Line

302. Flexible Pipe Cleaning Co., operating with specialized equipment and trained crews, is prepared to remove scale, rust and other deposits from pipes for every type of service. For details and estimates furnished without obligation write Flexible Pipe Cleaning Co., Box 167, Los Nietos, Calif. or check the coupon

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. or check the coupon.

SAVE TIME, MONEY, LABOR WITH THESE STURDY PUMPS

Enclosed unit. All working parts are readily accessible.

● Just turn the high pressure hose on that heavy equipment for a quick clean-up. The solid, hard, driving, high pressure stream from a Hardie Powered Pump Unit will strip off the caked mud, grease, dirt—even that "behind the ears"—in a matter of seconds.

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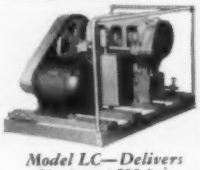
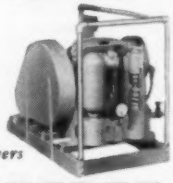


Model LC—Delivers 50 gpm at 800 psi.



Model XCVA—Delivers 18 gpm at 600 psi.

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New Ford Tractor lowers costs,

speeds roadside maintenance!

More and more economy-minded governmental units are using Ford Tractor power for roadside and street maintenance. They like the wide variety of jobs it can handle, and the number of days in the year it can be used. Here's how you can use it, too:

Speed roadside mowing with a Ford Tractor and Rotary Cutter (shown below). Works up to 300% faster than conventional mowers. Costs less to operate and maintain—no sickle bars to buy, no belts to replace.

Cut guard-rail costs with a Ford Tractor equipped with Driver and Breaker. Drives posts in minutes. No holes to dig, no compacting to do! Breaks concrete and rock, tamps dirt, too. One-man operated.

Maintain roads for less with a Ford Tractor and Adjustable Rear Blade. Use it to shape crowns, level berms, mix aggregate, grade and ditch. Six-foot blade is fully adjustable, hydraulically controlled.

Clear snow fast with a Ford Tractor equipped with an Industrial Loader and Blade Snow Plow. Attach a bucket to load snow, handle salt and chemicals. Compact and highly maneuverable for work on busy streets.

To see how a Ford Tractor can stretch roadside maintenance dollars all year long on many other jobs like these, call your nearby Ford Tractor and Equipment Dealer. He's at your service! Tractor and Implement Division, Ford Motor Company, Birmingham, Michigan.

See your nearby FORD TRACTOR AND EQUIPMENT DEALER

Get full details of this month's products . . . mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 5415, Columbus 19, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the coupon to get your copy.

Service Bodies to Suit Your Maintenance Needs

260. Service bodies, tailored to fit the needs of any municipal department and featuring many outstanding features of construction and design, are described in literature of Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N. Y. The new line has models to fit all popular truck chasses; ½ to 1½-ton; single or dual wheel. Be sure to check the 18 different compartment arrangements offered —there is one that is best for the convenience and efficiency of your maintenance crews. Use the handy coupon today.

Trencher Fits Municipal Needs

315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, maneuverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the coupon.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wis. Check the coupon for your copy.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the coupon.

Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwaukee 14, Wis. Detailed specifications are included. Check the coupon for your copy.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use coupon or write to Fairbanks, Morse & Co., Dept. P. W., Chicago 5, Ill.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y. Check the coupon for your copy.

Engineering Data on Asbestos Cement Pipe

372. Advantages of corrosion-free asbestos-cement pipe for water distribution plus full data on installation methods, cutting, making connections, testing, dimensions and weights are contained in the bulletin, and "Mains Without Maintenance," issued by Keasby & Mattison Co., Ambler, Pa. Get your copies by checking the coupon.

STREETS AND HIGHWAYS

Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, but without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

Tractors and Equipment for Municipal Use

337. Specifications for the John Deere "40" crawler and "40" utility wheel tractors, together with equipment for loading, dozing, mowing, sweeping and many other operations is covered in a comprehensive illustrated catalog issued by John Deere, Dept. 66B, Moline, Ill. Get your copy by checking the coupon.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

Fast Marker for Traffic Guide Lines

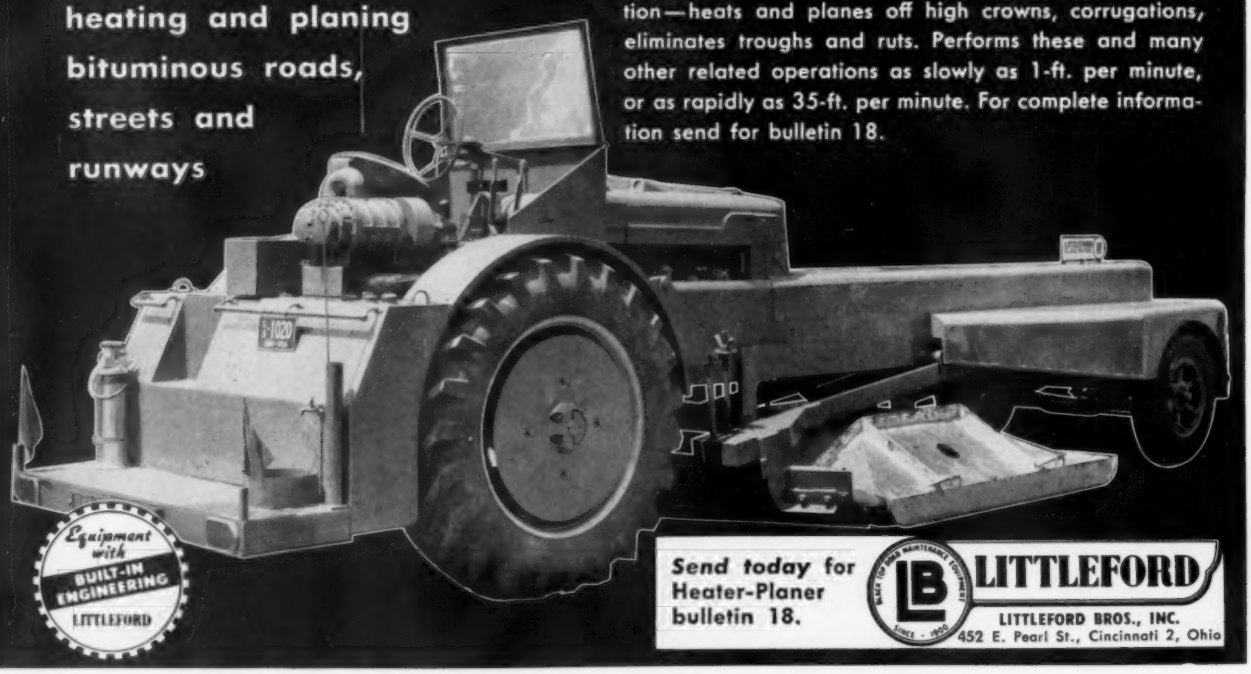
155. Free-floating, adjustable paint shields on the Mark-Rite Econo-Liner follow surface contours and produce sharp lines in any width from 2" to 6". This machine is said to paint 10,000 to 15,000 feet of line per hour. For details get Form E-100 from Universal Mfg. & Sales Co., 5211 Pacific Blvd., Huntington Park, Calif.

NEW **Littleford-Clarkmoore Asphalt Road Heater-Planer**

Heats and Planes in one continuous operation!

engineered unit for heating and planing bituminous roads, streets and runways

No other unit like it! This ingenious new machine—with one man at the controls, and in one continuous operation—heats and planes off high crowns, corrugations, eliminates troughs and ruts. Performs these and many other related operations as slowly as 1-ft. per minute, or as rapidly as 35-ft. per minute. For complete information send for bulletin 18.



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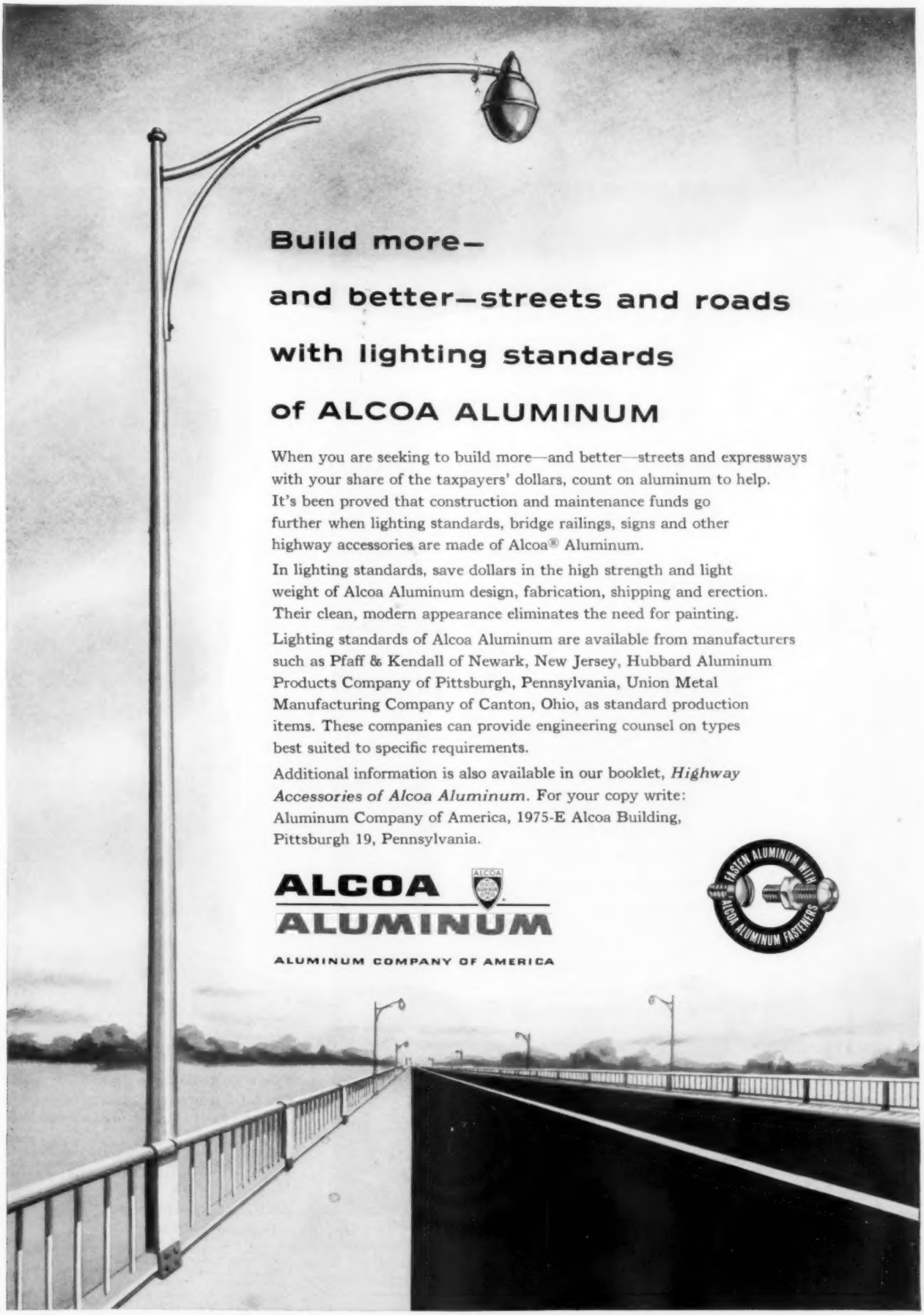

Build more—

and better—streets and roads

with lighting standards

of ALCOA ALUMINUM

When you are seeking to build more—and better—streets and expressways with your share of the taxpayers' dollars, count on aluminum to help. It's been proved that construction and maintenance funds go further when lighting standards, bridge railings, signs and other highway accessories are made of Alcoa® Aluminum.

In lighting standards, save dollars in the high strength and light weight of Alcoa Aluminum design, fabrication, shipping and erection. Their clean, modern appearance eliminates the need for painting.

Lighting standards of Alcoa Aluminum are available from manufacturers such as Pfaff & Kendall of Newark, New Jersey, Hubbard Aluminum Products Company of Pittsburgh, Pennsylvania, Union Metal Manufacturing Company of Canton, Ohio, as standard production items. These companies can provide engineering counsel on types best suited to specific requirements.

Additional information is also available in our booklet, *Highway Accessories of Alcoa Aluminum*. For your copy write: Aluminum Company of America, 1975-E Alcoa Building, Pittsburgh 19, Pennsylvania.

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PROBLEMS
Ferric salts have proven their ability to coagulate waters of widely varying turbidity. Spring rains increase turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is partially hydrated Ferric Sulphate that has the ability to convert these high turbidities without radical dosage changes.
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A large filtration plant Superintendent has this to say:
For coagulation of high turbidity with a high PH we have found Ferric Sulphate to be superior in all cases and we would not hesitate to recommend it.
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Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the coupon.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem, reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16-page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the coupon for your copy.

Heater-Planer Gives Low-Cost Surface Repairs

287. Low-cost resurfacing and repair work on bituminous pavements is made easy with the Littleford-Clarkmoore Heater-Planer. Machine operates continuously, heating and planing as it travels. Precise control leaves smooth riding surface. Get the details by writing to Littleford Bros., Inc., Cincinnati 2, Ohio, or check the coupon.

Windrow Loader is Tailor Made for Majority of Highway Needs

296. The peculiar problems of windrow loading require in most cases a medium capacity, low cost, highly maneuverable machine. To meet these needs Barber-Greene Co. now has a 4 cu. yd. per min. Windrow Loader, mounted on a John Deere wheel tractor. Further details may be obtained from Barber-Greene Co., Aurora, Ill. by checking the coupon.

Hot or Cold Patching Mixtures Prepared on the Job

304. By preparing your patching mixtures, hot or cold, right on the job, you can use them immediately with a minimum of handling. Get full data on the McConnaughay Model HTD "Multi-Pug" Asphalt Mixer for fast, easy and economical preparation of patch materials. Write K. E. McConnaughay, Layfette, Ind. or use the coupon.

What A Road Roller Should Give You

325. Many engineering design features that make Buffalo-Springfield rollers the answer to your needs are described in an attractive bulletin covering the C-Model Two-Axle Tandems of Buffalo-Springfield Roller Co., Springfield, Ohio. Included are details on open gridwork for better operator visibility, increased ground clearance and bevel gear drive. Investigate these and many other features listed in Form No. S 61-53. Check the coupon.

What Equipment is Needed By Modern Community Services?

328. The importance of modern equipment in work programs is graphically illustrated in the 16-page booklet "Allis-Chalmers Offers New Economy for Villages, Townships, Counties, Cities, States, Federal." Action photographs span the range of community projects and illustrate tractors, scrapers, graders, power units and their multi-purpose attachments. Get this handsome booklet and review your needs today. Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee 1, Wis. Check the coupon.

Two-Way Radio Equipment For All Departments

363. The benefits of two-way radio communication in the uncongested non-interference 450-megacycle range make full information on this subject important to all engineers. Get full data on trouble-free systems from Motorola, Inc., Dept. PW, 4545 Augusta Blvd., Chicago 51, Ill. Just check the coupon.

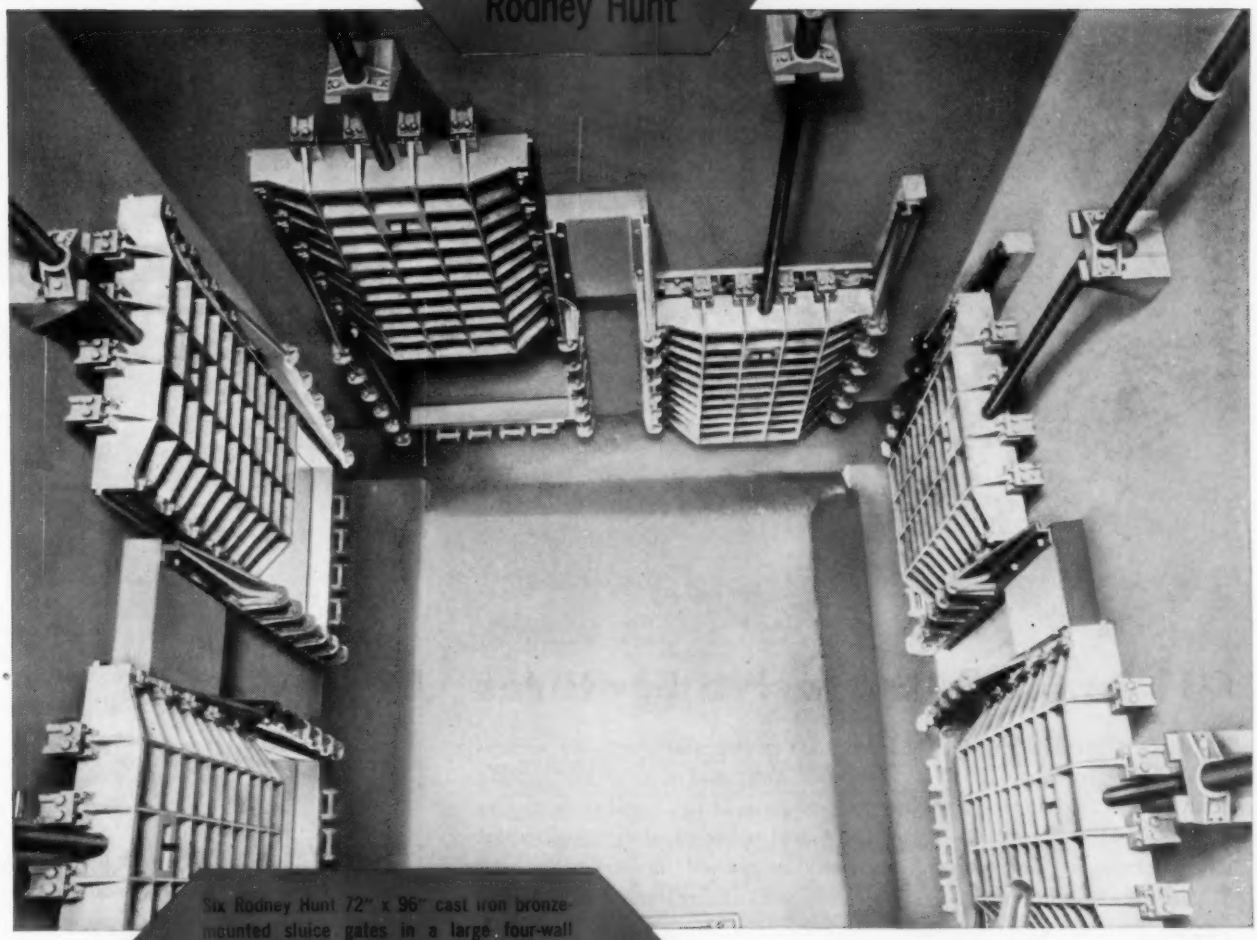
All-Purpose Tractor Introduced by Oliver

391. Be sure to get full information on the Oliver Super 55 tractor, a new model designed to do every kind of municipal job. Takes all equipment, front, rear or side mounted; has built-in hydraulic system. Available with gasoline or diesel power. To get all the facts write The Oliver Corp., 400 W. Madison St., Chicago 6, Ill., or check the coupon.

To order these helpful booklets check the coupon on page 32.

When you must be SURE...

specify Rodney Hunt



Six Rodney Hunt 72" x 96" cast iron bronze-mounted sluice gates in a large, four-wall gate well chamber of a modern underground filtration plant. The two at left are inlets from the filter plant. Two in the middle act as inlet gates to the pH chamber. The two at right control the inlet passage to the main storage basin. All are built to withstand an unseating pressure exceeding 50 feet.

For Instance...

Think how important it was on this huge project to be sure of proved design, dependable operation and long life, *always* engineered into Rodney Hunt equipment. In addition to units shown, other Rodney Hunt sluice gates as big as 8′ x 8′ clear opening were installed in this underground reservoir and filter plant built for one of our greatest cities.

When you must be SURE...

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More than 2000 combinations of Sluice Gates and Hoists are described in our 232-page profusely illustrated catalog with valuable 28-page section on engineering data. Write *today* on your letterhead for Catalog WCA 952.

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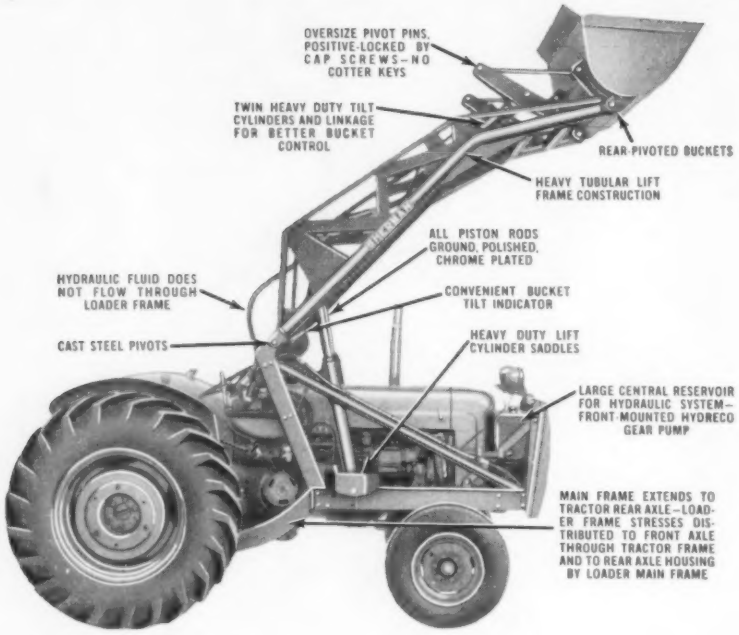
New Sherman Front End Loader with Balanced Combination of REACH...HEIGHT...CAPACITY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CAST STEEL PIVOTS
HEAVY DUTY LIFT CYLINDER SADDLES
LARGE CENTRAL RESERVOIR FOR HYDRAULIC SYSTEM—FRONT-MOUNTED HYDRECO GEAR PUMP
MAIN FRAME EXTENDS TO TRACTOR REAR AXLE—LOADER FRAME STRESSES DISTRIBUTED TO FRONT AXLE THROUGH TRACTOR FRAME AND TO REAR AXLE HOUSING BY LOADER MAIN FRAME

Offers Many Exclusive Features

This new Sherman Front End Loader gives you *more for your money!* Loading height up to 10'10" . . . loads to front end of an 8' truck body from rear . . . bucket capacity up to 2500 pounds . . . breakaway capacity up to 4500 pounds . . . yes, these and other carefully engineered design features give you more than any comparable machine.

The husky main frame transmits loads to the tractor rear axle for greater traction and maximum performance with minimum strain on the tractor. Twin heavy duty tilt cylinders crowd bucket or attachments right in to do a man-sized job on excavating, loading, bulldozing, stripping, back-grading, bulk material handling, and many other jobs. Two models—up to 2500 lbs. payload.

The Sherman Front End Loader is economical, easily installed, safe and easy to operate . . . and sold by Ford Tractor dealers everywhere, your assurance of convenient, dependable service. Ask your dealer for an on-the-job demonstration—or write for Bulletin No. 511.

Sherman

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ROYAL OAK, MICHIGAN

Sherman SP Products

SHERMAN FORK LIFT
•
SHERMAN POWER DIGGER
•
SHERMAN FRONT END LOADER*

*THE SHERMAN FRONT END LOADER IS MANUFACTURED EXCLUSIVELY FOR SHERMAN PRODUCTS, INC. BY JOHNSON HYDRAULIC EQUIPMENT CO., MINNEAPOLIS, MINN.

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Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal, and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the coupon.

Advanced Tractor Design Gives Better Performance

399. For greater power, performance and economy, Ford Tractor offers 4-wheel stability, built-in hydraulic system and power take-off among the many new features. A complete booklet describes five models in two power series, showing the latest in advanced tractor design. For your copy check the coupon or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Better Mowing and Brush Removal

403. Fast, versatile tractor drawn Wood rotary mowers are available in a large selection of models to suit all types of municipal and highway department maintenance requirements. Be sure to investigate these units and discover how costs of roadside mowing, brush cutting, leaf mulching and park maintenance can be reduced with efficient equipment. Get full details by checking the coupon or from Wood Bros. Mfg. Co., Oregon, Ill.

How to Save on the Cost of Signs

405. Sign costs have been reduced significantly by many cities, counties and states that switched to Alcoa aluminum for signs and markers. Strength and corrosion resistance cut maintenance costs; aluminum fasteners mean trouble-free installation. For full material specifications write Aluminum Company of America, 1978-D Alcoa Bldg., Pittsburgh 19, Pa., or check the coupon.

•

CONSTRUCTION EQUIPMENT AND MATERIALS

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the coupon. Sherman Products, Inc., Royal Oak, Mich.

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Holmes Co., Chattanooga, Tenn.

Safety Lantern With Pencil Beam Signal

70. Get information on the Dietz "Night Watch" Safety Lantern with special globe design that saves fuel by intensifying light rays into a pencil beam. Full details available from R. E. Dietz Co., Syracuse, N. Y. Just check the coupon for full data.

Helpful Booklet on Carryable Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Both gasoline and electric models are discussed, and requirements outlined for many applications. Just check the coupon for your copy. The Homelite Corp., 2125 Riverdale Ave., Port Chester, N. Y.

Booklet Helps Design of Custom-Engineered Steel Buildings

110. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the coupon or write to Butler Mfg. Co., Kansas City, Mo.

How to Get Better Grader Operation

111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the coupon for your copy.

Drill Concrete With Your Ordinary Electric Drill

130. Substantial cost-per-hole savings are claimed for Tilden rotary drills which penetrate up to 6 ins. of concrete per minute. Cuts right through reinforcing steel. Cutters can be resharpened. Full data from Tilden Tool Mfg. Co., 209 Los Molinos, San Clemente, Calif. Check the coupon today.

Getting Specified Density In Granular Bases and Fills

188. Vibratory compactors offer the means for getting specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Just one pass may suffice. Get complete information from Jackson Vibrators, Inc., Ludington, Mich. See how adaptable compactor units handle a variety of compaction needs. Check the coupon today.

Choosing Trucks For Municipal Service

204. Trucks that are high in efficiency and economy are needed for all municipal services. Be sure to investigate latest models of White motor trucks, engineered for high performance under all conditions. Full details from White Motor Co., Cleveland 1, Ohio. Check the coupon today.

Chipping Machine Handles Concrete Removal

225. Details on a high-speed concrete router which handles surface removal prior to resurfacing operations is offered by the G. H. Tennant Co., 2578 No. 2nd St., Minneapolis 11, Minn. Be sure to investigate this versatile machine which, with interchangeable cutter heads, will rout out cracks, clean pavement joints, level humps, etc. Check coupon for details.

Lightweight Drill Aids Soil Sampling

228. Two Acker core drills, models LD and LLD, are described in Bulletin No. 21 recently made available by the Acker Drill Co., 725 W. Lackawanna Ave., Scranton, Pa. Used for cutting highway test cores, soil samples, drainage holes and for foundation test drilling, these machines are designed for fast and economical operation. Get the details by checking the coupon.

Melting and Soldering Made Easier in Shop and Field

234. Insto-Gas torches and furnaces give trouble-free service for lead melting, soldering and all other jobs where a steady, clean, hot flame is needed. Convenient cylinders require no regulating gauges and attach directly to standard furnace assembly. Full details from Insto-Gas Corp., 1977 E. Woodbridge St., Detroit 7, Mich. by checking the coupon.

Investigate "Tifa" For Insect Control

308. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use coupon for full data on public health programs. Combustion Equipment Div., Todd Shipyards Corp., 81-16 45th Ave., Elmhurst, N. Y.

How a Sherman Power Digger Does More Work in Less Time with No Standby Equipment

Nearly every department in the city of Hopkins, Minnesota, finds a use for this versatile Sherman Power Digger.

The Water Department uses the machine when cutting off discontinued service lines at the main. They dig a hole in the street (usually blacktop) 3′ wide by 6′ long by 8′ deep. The hole must be plumbwalled for minimum replacement of paving. This operation used to tie up a truck all day, an air compressor half a day, and two men with hand tools, a full day.

Using a Sherman Power Digger, they now do *three* such jobs in one day, with only one man on the digger, no truck, and no compressor, except for concrete pavement. The job goes faster because they can dig the hole, shut off the line, and backfill before the walls begin to cave. Local soil conditions formerly required cribbing many of these excavations.

If *your* work involves the construction or maintenance of underground facilities, you will profit with a Sherman Power Digger. It's compact, fast, and flexible, with low initial cost and amazing economy of operation. Write today for full details, without obligation. Ask for Bulletin No. 512.

SHERMAN FORK LIFT
•
SHERMAN POWER DIGGER*
•
SHERMAN FRONT END LOADER

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PRODUCTS, INC.
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*DESIGNED, ENGINEERED AND MANUFACTURED JOINTLY BY SHERMAN PRODUCTS, INC., ROYAL OAK, MICHIGAN, WAIN-ROY CORPORATION, HUBBARDSTON, MASS. PATENT NO. 2,303,051 OTHER PATENTS PENDING. © SHERMAN PRODUCTS, INC., 1953

8 Reasons Why You Should Check the Jaeger Loader

207. In a profusely illustrated 16-page catalog devoted to the applications and special design features of the Jaeger "Load-Plus" tractor-loader unit, eight good reasons listed to back up the claim that this machine outproduces any other loader of its size. These include load capacity, balance, reach, maneuverability, automatic power adjustment by torque converter, instant reversal, multiple speed and ease of control. Check them all by getting a copy of Catalog L100-3. Check the coupon today. Jaeger Machine Co., 400 Dublin Ave., Columbus 15, Ohio.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the coupon.

How to Select Paints For Every Maintenance Need

253. Selecting the right paint for each maintenance need involves consideration of the service to be rendered, conditions of their use and abuse, and the surfaces to which they are to be applied. To help you determine what to use on various surfaces, an industrial paint index printed in the form of a handy file folder has been prepared by the Tropical Paint and Oil Co., Cleveland 2, Ohio. Get a copy by checking the coupon.

How to Get Better Concrete Construction

313. A report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented by Master Builders Co., Cleveland 3, Ohio. Check coupon for your copy.

Auxiliary Equipment For Use with the "Jeep"

326. Be sure to investigate the versatile "Jeep" as a source of auxiliary power in combination with convenient transportation. Power take-off operates air compressors, generators, other equipment. For details write to Willys Motors, Inc., Toledo 1, Ohio, or check the coupon.

Automatic Cutter Saws Cast Iron Pipe

393. This portable automatic pipe saw, available with either pneumatic or electric drive, makes fast precision cuts in 8-in. to 60-in. cast iron or steel pipe. Features are light weight, minimum clearance required, easy operation even when submerged. Get details from Prescott Tool Co., Inc., Worcester, Mass., by checking the coupon.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Sales Corp., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook

Effective Shredder for Dried Sewage Sludge

45. The rugged and compact Royer Shredder does a quick and effective job of disintegrating sludge cake to produce a good fertilizer for use on city properties or for sale to others. Six sizes, 6 to 150 c. y. per hour, electric, gasoline or power takeoff, stationary or portable are described in Bulletin 55-RS. Write Royer Foundry & Machine Co., Kingston, Pa., or check the coupon for your copy.

What You Should Know About Design and Use of Concrete Sewers

122. Every engineer and contractor should have a copy of the 48-page book "Concrete Sewers" in his library. This valuable text, published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 33, Ill., gives an authoritative discussion of hydraulics, sewer design, construction and maintenance. Generous use of helpful illustrations makes the book attractive and helpful to the reader. For your copy, just check the handy coupon.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe joining methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the coupon for free copy.

"Float-Treat" Process For Industrial Wastes

333. The Rex "Float-Treat" process, a system used to separate greases, chemical flocs and suspended organic matter from industrial waste liquids, is the subject of a new booklet issued by Chain Belt Co., Milwaukee 1, Wis. Detailed description includes plan views, diagrams, photos and text. Get Bulletin 54-82 by checking the coupon.

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$ . . . on pipe runs under streets, highways, pavement, gardens, etc.

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OPEN HOLE

AVOID TIME WASTE

Hydrauger is a modern, time-saving way to install underground pipe . . . avoids trenching, backfilling, pavement cutting, etc.

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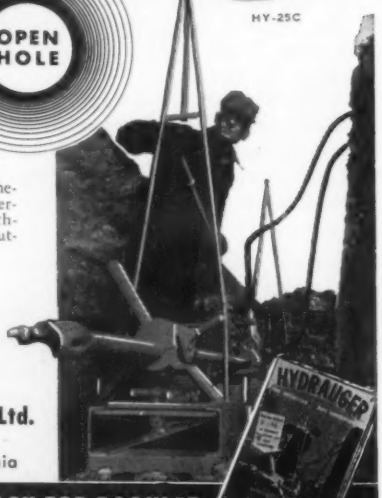

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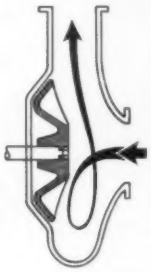
THE WEMCO TORQUE-FLOW SOLIDS PUMP

Rags, stringy fibrous materials and thick sludges can flow through this pump indefinitely without accumulating or clogging. Bar screens can be eliminated — pump inspection periods can be lengthened — and messy pump teardowns become almost a thing of the past.

FIELD PROVEN BY LOS ANGELES COUNTY SANITATION DISTRICT

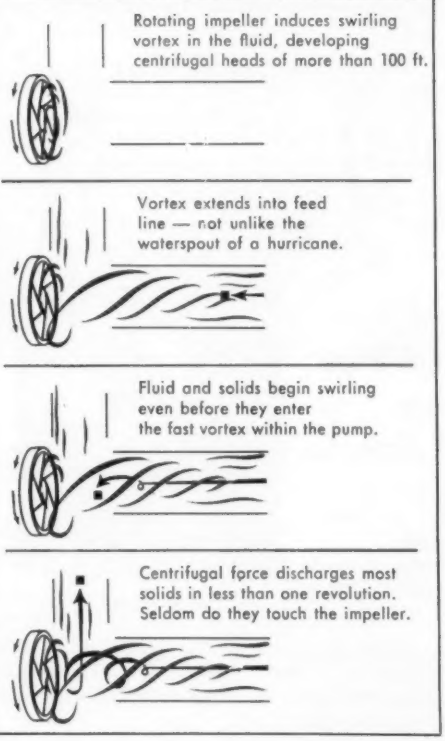
A "hand made" early model Wemco Pump was installed on a 90 day trial pumping raw settled sludge. Previous modern pumps had been ragging-up in excess of four times per week. The trial period was completely successful. Not a single stoppage occurred. Even this hand made model is still in continuous operation after more than fourteen months. This resulted in many additional pumps being installed at other critical points in the system.

COMPLETELY NEW IN CONCEPT



Success of the Wemco Torque-Flow Solids Pump is due to its unique new principle. Nowhere is its flow passage narrower than the discharge — and there are no rag catching projections, corners, or edges. The impeller is recessed from the main flow. It pumps by inducing a vortex and swirl. It will create suction lifts greater than 20 feet or pump heads of 100 feet and more.

Here is how it works


Rotating impeller induces swirling vortex in the fluid, developing centrifugal heads of more than 100 ft.
Vortex extends into feed line — not unlike the waterspout of a hurricane.
Fluid and solids begin swirling even before they enter the fast vortex within the pump.
Centrifugal force discharges most solids in less than one revolution. Seldom do they touch the impeller.

Write for full particulars to Dept. M-2045

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REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA AND IN MAJOR COUNTRIES THROUGHOUT THE WORLD

Now's the time to mail this month's Readers' Service card.

To order these helpful booklets check the coupon on page 32.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833-A. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 1o, Ohio.

Indicating, Recording and Totalizing Meter

218. For accurate measurement of water, gas, air, sewage, sludge, etc., the Simplex Valve & Meter Co., 7 E. Orange St., Lancaster, Pa. developed the Type H-Meter. This mercury flow type indicating, recording and totalizing unit operates in conjunction with Venturi tubes, flow nozzles and orifice plates. Full description of this meter and installation data in comprehensive Bulletin 402, available by checking the coupon.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the coupon for your copy.

Instrumentation and Control Equipment For Water and Sewage Plants

298. Full engineering data on the instrumentation and control equipment needed in water works, sewage plants, pumping station and related installations are provided in the "Application Engineering Data" binder issued by the Foxboro Co., Foxboro, Mass. Every engineer and designer should have this valuable material on hand. Check the coupon if you can use this data.

Informative Bulletin Discusses Versatile Sewer Structures

334. Choice of the right type of sewer structure involves consideration of installed economy, long life, easy handling and fast assembly. For a helpful discussion of these important factors and a convenient table for selection of the most suitable type of structure get Folder CMS 6154 by checking the coupon. Armco Drainage & Metal Products, Inc., Middletown, Ohio.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

For Prompt Service Use The Coupon

Have You Heard About Bionetics For Sewage Treatment?

350. Bionetics, a dry staple powder of groups of living organisms preserved with enzyme systems, is available in several types to improve and accelerate the biological processes performed at sewage treatment plants. Get full data from Reliance Chemicals Corp., Box 6724, Houston 5, Texas. Just check the handy coupon.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the coupon.

Tables Simplify Selection of "Flush Kleen" Sewage Ejectors

386. "Flush Kleen" selection is made easy by a series of engineering tables offered in Bulletin 123 by the Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill. Station types, flow determination, pump capacity and procedures for determining total dynamic discharge heads are outlined in detail. Get this useful reference by checking the coupon.

●

WEED CONTROL

What You Should Know About Chemical Weed Control

132. In a convenient 44-page book, the C. B. Dolge Co. gives full details on spraying procedures and chemicals to use for control of lawn and roadside weeds, ragweed eradication and insect control in turf. Get your copy by checking the coupon or write C. B. Dolge Co., Westport, Conn.

Weed Killing Case Histories

205. Weed and grass control lasts longer . . . costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the coupon for your copy.

Powerful Mist Sprayer Controls Pests

241. Mist sprayers for shade tree and mosquito control, roadside weed control sprayers and a full line of pressure pumps, engine equipment and spray guns in assemblies for every spraying need are presented in an illustrated catalog by Hardie Mfg. Co., Hudson, Mich. Get 40-page Catalog No. PC 57 for data on all types of chemical spray and dust equipment. Check the coupon.

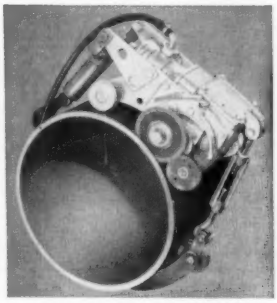
KWIK-MIX Bituminous Mixers set up anywhere for economical, one-man handling. Both 10 and 14 cu. ft. sizes are readily adaptable as stationary, elevated plants. Operator controls charging, mixing and discharging without leaving platform. Skip, receiving aggregates from truck at ground level, is raised by power up an extension track to charge drum. Non-tilting drum discharges mixed batch into trucks or hoppers in 6 seconds. Mixers also mount on rubber tires for mobile, on-the-job mixer service. Ask Kwik-Mix distributor for details, or write for catalog.

mail to: KWIK-MIX CO., 3029 W. Concordia, Milwaukee 16, Wis.
(Koehring Subsidiary)
Send us literature on: ☐ 10 ☐ 14 cu. ft. Bituminous Mixers
NAME
TITLE
ORGANIZATION
ADDRESS KM366PW

Jein

PORTABLE AUTOMATIC PIPE CUTTERS
with Pneumatic or Electric Drive

for Cast Iron and Steel Pipe from 6" to 60" diameter



- Weight: only 145 lbs.
- Clearance: 12" max. around pipe.
- Set up time: 5-10 min. by 1 or 2 unskilled men.
- Machines operate under water.
- Cuts 8" pipe in 5 min.—24" in 18 min.
- Also available: "V" cutter for welded steel pipe.

AMAZINGLY LOW COST

SIX MONTHS GUARANTEE

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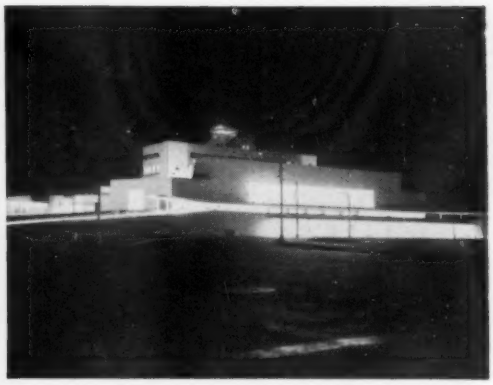
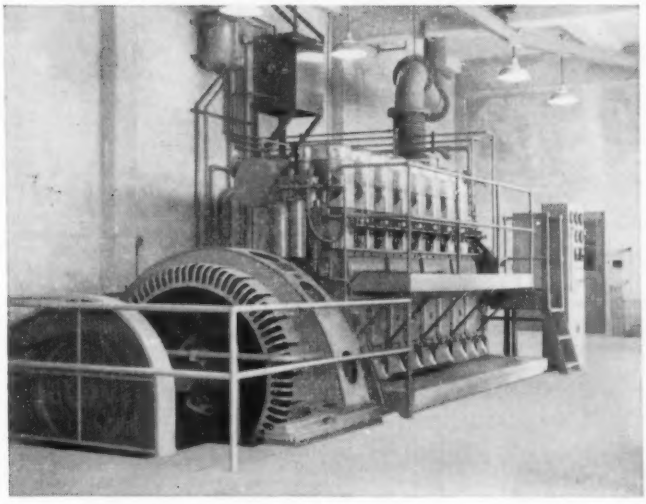
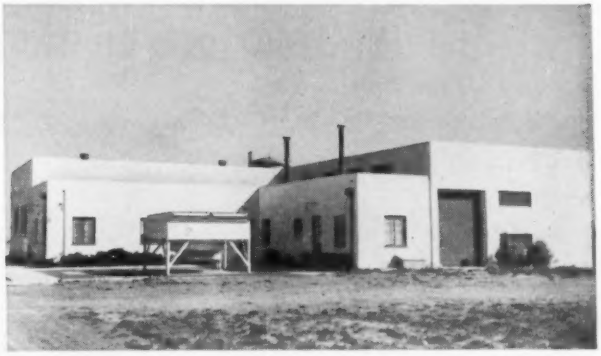
PRESCOTT TOOL CO., INC.
BOX 7 — GREENDALE BRANCH — WORCESTER 6, MASS.
TELEPHONE TEmple 5-4431



Enterprise emergency power guarantees immediate light for the control tower, runways, and more than 466,000 sq. ft. area in terminal building with its three concourses. Here, 27 loading stations serve 11 airlines.

No blackouts at San Francisco Airport with 1000 KW Enterprise standby unit



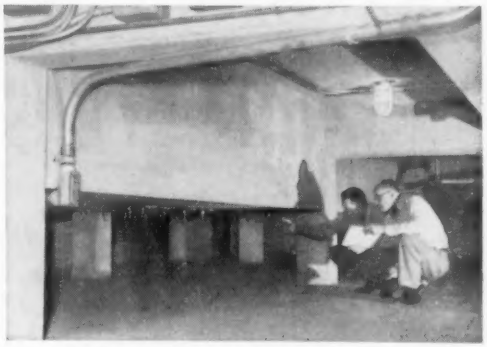


First fully automatic unit of its type in the U.S., this Enterprise standby plant also powers drainage pumps in case of airfield flooding.

Compactness of the Enterprise engine enabled easy installation in the existing building.

Power failure at this busy new $50,000,000 International Airport would create emergencies of major proportions. But with the Enterprise diesel-electric, *fully automatic* standby generator set now in operation, this will not happen. Within 13 seconds, if power fails, the Enterprise cuts in to supply all the power needed for normal operation of control tower, runway lights, and other essential airport facilities.

Enterprise Engines serve every municipal power need. You'll find these dependable engines ideally suited for stationary or portable electric generating plants... flood or water supply pumping systems... or for powering sewage disposal plants. Contact the Enterprise sales office in your area today, or write us direct about your problem.



Further proof of Enterprise adaptability and vibration-free operation is shown by the use of the concrete cradle which was an integral part of the building.

Over a million horsepower at work the world over!

ENTERPRISE dependable ENGINES

THE SWITCH IS TO ENTERPRISE
CHOICE OF POWER EXPERTS

ENTERPRISE ENGINE & MACHINERY CO. • **Subsidiary of General Metals Corporation** • **18th and Florida Streets, San Francisco 10, California**

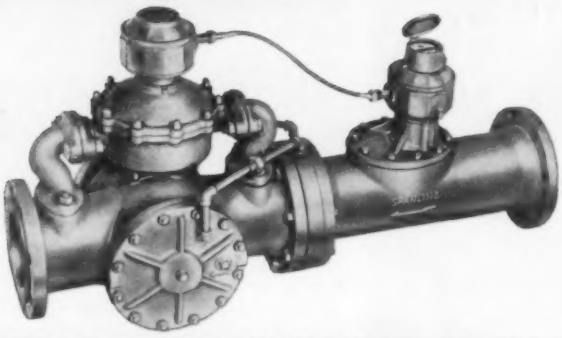
Boston • Chicago • Denver • Jacksonville • Kansas City • Los Angeles • Minneapolis • New Orleans • New York • San Diego • Seattle • St. Louis • Washington, D.C.

Get full details of this month's products . . . mail your Readers' Service card today.

To order these helpful booklets check the coupon on page 32.

SPARLING

WATER CONTROL EQUIPMENT



BROAD-GAUGE COMPOUND METERS

accurately register flows over 1 to 1000 range

Where extremely low flows in main-lines must be logged, the SPARLING BROADGAUGE is ideal! On a 6-inch line, for example, flows of 900 GPM—or more—are measured with practically no head loss, while flows of 2 GPM are logged accurately, too.

The compound valve opens automatically and closes by line pressure. A transmitter can be added for remote indication, recording, or for auto-metered control of chemical feeds. Available in sizes 6", 8", 10" and 12".

Your request for CF-333 brings full information.

SPARLING METER COMPANY

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ATLANTA 3.....66 Luckie Street NW
BOSTON 8.....6 Beacon Street
CHICAGO 8.....1500 South Western Ave.
CINCINNATI 2.....626 Broadway
DALLAS 1....726 Reserve Loan Life Bldg.
KANSAS CITY 6, MO.....6 E. Eleventh St.

Box 3277.....LOS ANGELES 54
3530 Forbes St.....PITTSBURGH 13
101 Park Avenue.....NEW YORK 17
85 Industrial St.....SAN FRANCISCO 24
1932 First Avenue .....SEATTLE 1
207 Queens Quay West..TORONTO, CAN.

When The Job is Moving . . . KEEP MOVING

Without Diesel Fuel Injection Troubles

Save Half the Cost of new injectors with

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Save Half the Cost

We Mean It—Just Look

Caterpillar Pump

Hancock reclaimed, tested, calibrated, 7 - 8 - 10 MM, right or lefthand helix, only $12.00

Caterpillar Nozzle—Hancock reclaimed, pop pressure set gaskets furnished, ready to install, any size, only $10.70

GMC, Nos. 71, 110—We reclaim complete Injectors; similar service on Cummins, American Bosch and International Injection Equipment.

In Most Areas You Get Quickest Service From Your Nearby Diesel Injection Service Shop. If There is no Hancock Dealer in Your Area, Send Worn Parts Direct to:

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DIESEL SERVICE CO.

373 Walnut St. • Findlay, Ohio

M - SCOPE PIPE-LOCATOR

"ELECTRONIC WITCH"

BASE PRICE ONLY $162.50

- With built-in "A" and "B" battery checkers $12.50 extra
- With all leak detector attachments complete $207.50
- Immediate delivery
- Fully guaranteed

FREE LITERATURE

FISHER RESEARCH LAB., Inc.

PALO ALTO CALIF.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigar Iron Works, 1033 Herman St., Nashville, Tenn

Safe-T-Cones Solve Traffic Problems Night and Day

222. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nighttime use—get bulletin from Radiator Specialty Co., Charlotte, N. C. Information included on Safe-T-Signs which add greatly to value of markers. Check the coupon now!

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "EZ-On" traffic signs faces ready for immediate shipments. Reflectorized faces cost only a fraction as much as new signs and are easily attached to existing traffic signs. Use the coupon for data today. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Permanent Street Signs Cut Maintenance Costs

345. Permanent cast aluminum street signs and markers of all types are described in a 32-page illustrated manual available from Lake Shore Markers, 654 West 19th St., Erie, Pa. Get full information on these distinctive markers, available in plain or reflectorized finish. Check the coupon.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems. Check the coupon for your copy of this helpful guide.

CIVIL DEFENSE

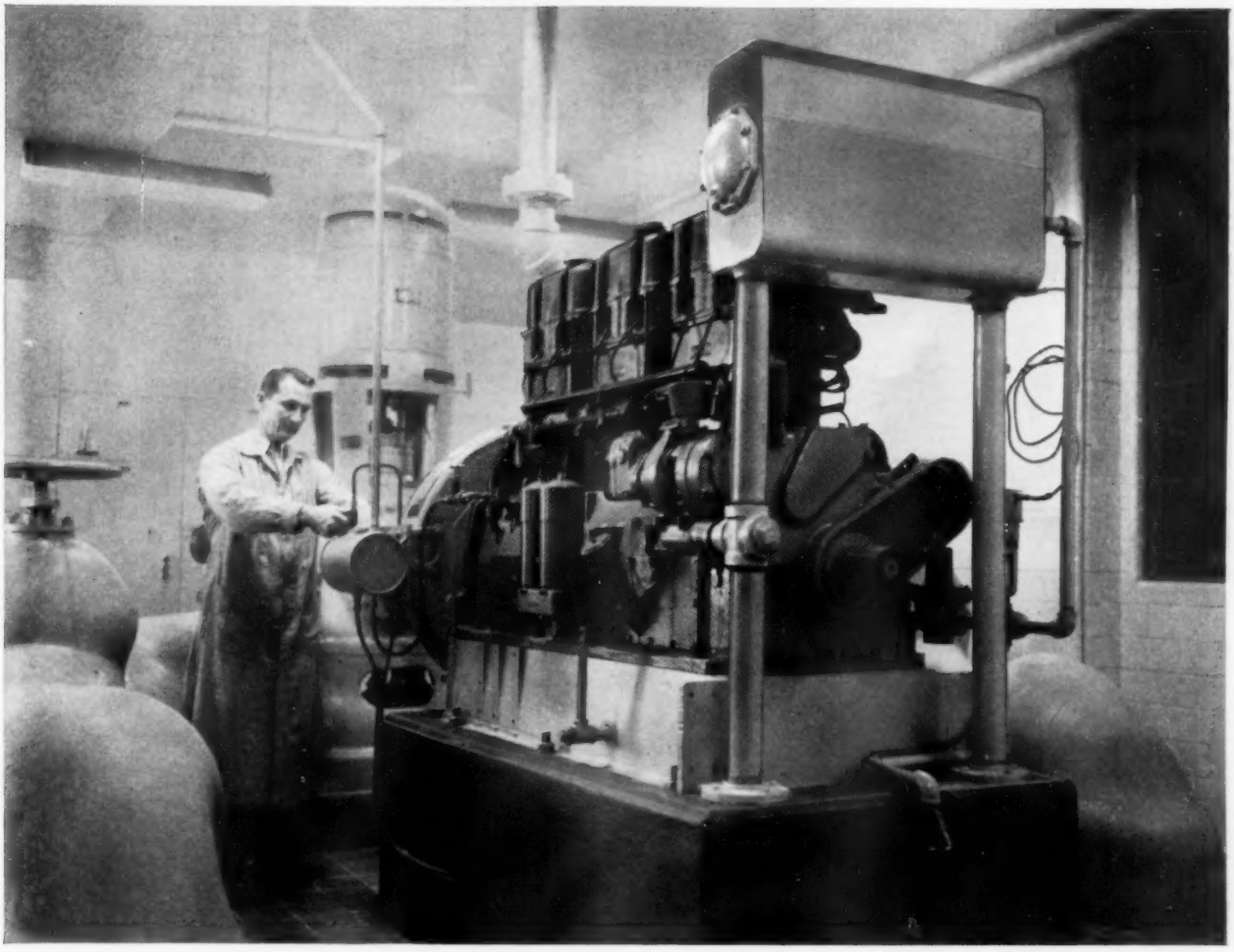
Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP-31 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 30 Kw, portable and stationary, are described. Write the Kohler Co., Kohler, Wis., or use the coupon.

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago, Ill., by using coupon.

Get full details of this month's products . . . mail your Readers' Service card today.



Standby...for Action

... the dependability built into Le Roi engines means that you have power when you need it most

The operator of the Le Roi F1500 shown above said, "This engine has surpassed our every requirement for standby power, and has more than paid for itself with dependable, economical, power production when we needed it most."

That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over $4000 a year for 14 years — others that have saved $7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 655 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

E-108

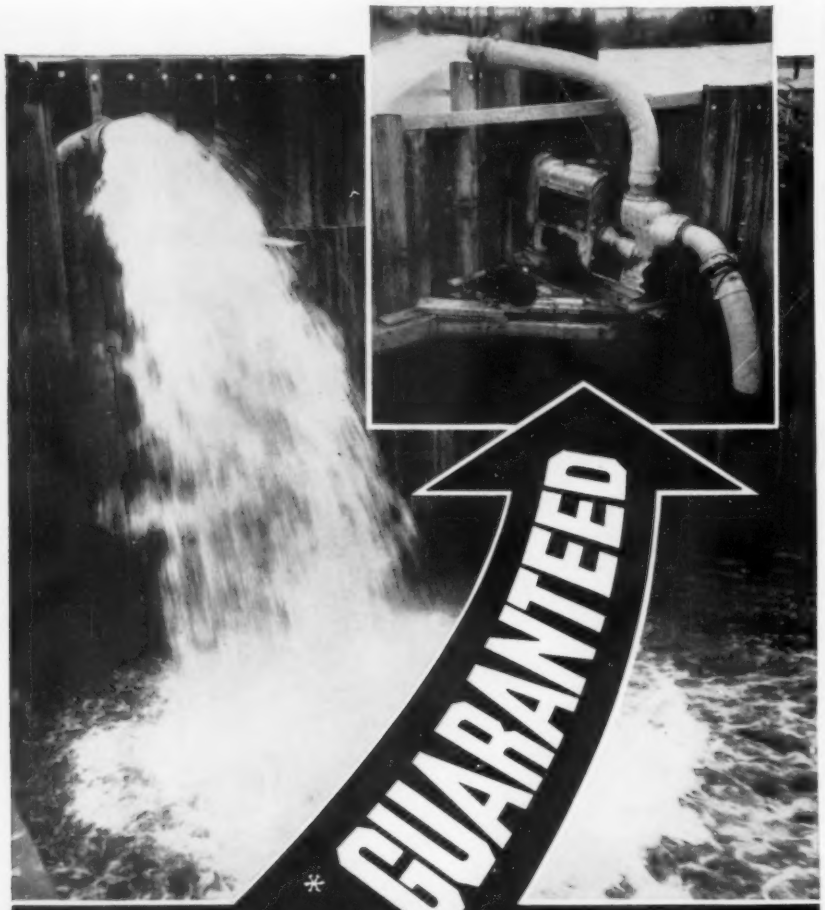
LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 14, Wisconsin

PORTABLE AIR COMPRESSORS TRACTAIR STATIONARY AIR COMPRESSORS AIR TOOLS ENGINES

Need more facts about advertised products? Mail your Readers' Service card now.

To order these helpful booklets check the coupon on page 32.



GUARANTEED

To do the JOB!

The river pours in — cofferdam piles spring leaks — men take risks or work is held up by flood water.

Dependable pumps are of vital importance, working side by side with the men, shift after shift, day in, day out.

To meet target dates, concrete pouring must be non-stop, trucks must move, the job must hum! Keep pumping and you do it.

Make sure — put Gorman-Rupps on the job *before* you have trouble. Our plain language guarantee is backed by a long record of proven performance *On-The-Job.*

**Ask for Bulletin and the Guarantee*

NOTES FROM THE FIELD

At the Sandusky River bridge on the Ohio Turnpike Gorman-Rupp pumps worked around the clock with men on 3 shifts. At times they pumped 3 weeks continuously, 24 hours a day and no trouble.

THE GORMAN-RUPP COMPANY
MANSFIELD, OHIO

Thousands use our Readers' Service card to keep up to date . . . do you?

RECREATION

Helpful Reference on Swimming Pool Equipment

53. A complete reference catalog of swimming pool supplies chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the coupon.

REFUSE COLLECTION AND DISPOSAL

Efficient Material Handling to Reduce Incineration Costs

148. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350-R. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy coupon or write Combustion Engineering Inc., Raymond Div., 200 Madison Ave., New York 16, N. Y.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16 yd. capacities. Get all the facts from M-B Corporation, New Holstein, Wis. by checking the coupon.

Roadside Cleaning Problems Simplified with the "Scavanger"

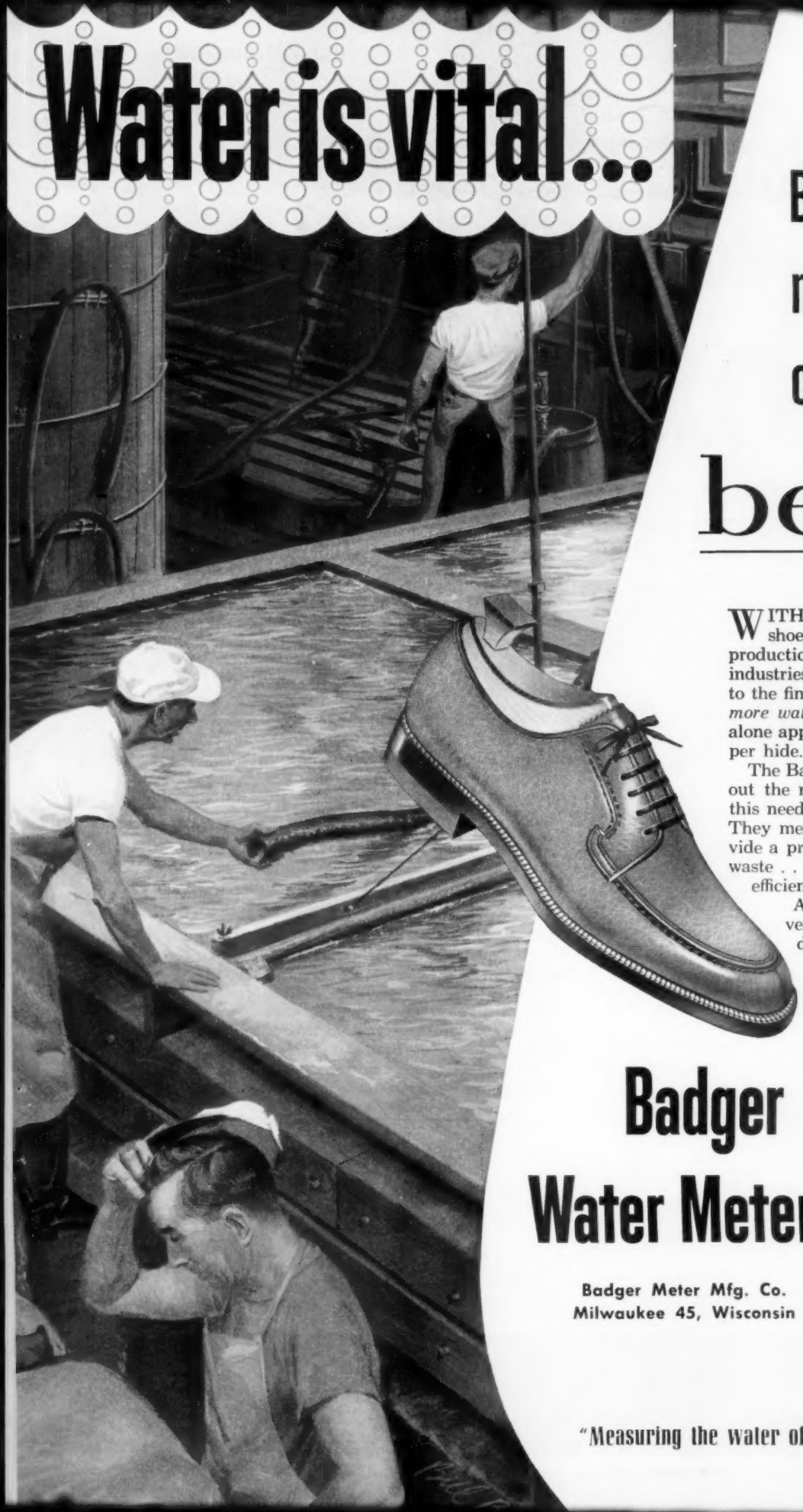
320. Be sure to investigate the Good Roads motorized "Scavanger" for the solution to your roadside cleaning problems. Powerful exhaust fan draws all types of debris into the air-tight body through a 12" dia. hose. Picks up bottles, cans, cartons, leaves, twigs, all kinds of debris—wet or dry. The 12 cu. ft. body is readily emptied with its own self dumping mechanism. Efficient, dependable filters hold back all solids to protect the blower rotor. Ket full information by writing to Good Roads Machinery Corp., Minerva, Ohio, or check the coupon.

What You Should Know About Refuse Incinerators

362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the coupon.

Need more facts about advertised products? Mail your Readers' Service card now.

Water is vital...



Badger meters conserve it better!

WITH more than 508-million pairs of shoes purchased last year, leather production is one of America's most vital industries. Yet, from the cleaning of hides to the final finishing of shoes, it takes far *more water than leather* . . . in tanning alone approximately 162 gallons of water per hide.

The Badger water meters used throughout the nation help conserve water for this need . . . just as they do for homes. They measure water accurately . . . provide a precise check on water usage and waste . . . make water departments more efficient and self-supporting.

As waterworks men everywhere verify, Badger meters do the job dependably . . . serve through the years with little or no attention.

Badger Water Meters

Badger Meter Mfg. Co.
Milwaukee 45, Wisconsin

"Measuring the water of the world for 50 years"

MILWAUKEE

"Makes Sure" WITH TYLOX Rubber PIPE GASKETS

PROJECT: Villard Avenue sanitary sewers, for Bureau of Sewers, Department of Public Works, Milwaukee, Wisconsin.

ENGINEERS: Lloyd D. Knapp, City Engineer; Edmund Hirsch, Engineer in charge of Sewer Construction Division; Ted Prawdzik, Chief Design Engineer; and Walter Schmitz, Construction Engineer.

PIPE: 21" and 24" reinforced concrete pipe, furnished by Waukesha Cement Tile Co., Waukesha, Wisconsin.

CONTRACTOR: W. J. Lazynski, Inc., Milwaukee, Wis.

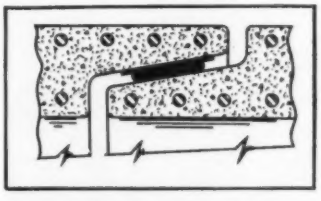
5003

"LEAKPROOF JOINTS" Was What Engineers and Officials Demanded For The City's New Villard Ave. Sewers. They Got Them—With a Tylox Rubber Joint Specification.

With public funds at stake, even the world-wide TYLOX reputation for *no joint-leaks* did not satisfy these officials. The line ran through wet soil areas which invited infiltration troubles. They had to *make sure*, and to get the proof, tests were ordered on flooded sections of completed line.

When we asked the engineers for results of the tests, we were not surprised at the answer . . . "Virtually *no* infiltration . . . We didn't even make a measurement."

Couple the certainty of "no infiltration" with the other advantages of TYLOX Joints — corrosion resistance . . . quick installation . . . flexibility — and you have the ONE pipe joint that meets requirements of taxpayer, designer and builder alike. Write us today for complete TYLOX information and more case histories. Read the facts, and on your next pipe project "make sure" of no joint leaks with a TYLOX specification.



This rubber-tight mechanical seal stays tight "for the life of the line."

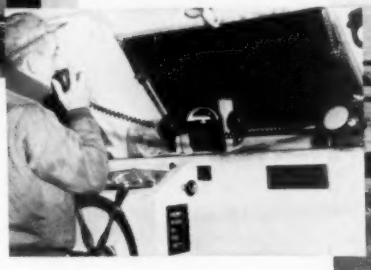
HAMILTON KENT MANUFACTURING CO.
427 W. Grant St. KENT, OHIO Orchard 3-9555

Get full details of this month's products . . . mail your Readers' Service card today.

Motorola 2-way radio

VITAL TOOL IN MACKINAC BRIDGE CONSTRUCTION

Supervisors have constant contact with all operations.



Boats are radioed orders from shore, saving travel time.

HERE'S HOW 2-WAY RADIO SPEEDS THE WORK

Tying in all the working forces building the giant 5-mile bridge across the Straits of Mackinac was a big task, but 38 Motorola 2-way radio units did the job successfully.

Floating derricks, job tugs, personnel boats, trucks, autos and land based stations—all are a few seconds away from each other with radio. Supervisors do a full-time job, transmitting new orders immediately and receiving important messages—in the auto, office, or on the water.

Adverse weather, wind and current reports are flashed instantly to off-shore crews . . . these same crews can radio and get quick help if injuries occur. In these, and a dozen other ways, Motorola radio is enabling the impossible — faster and at less cost.

HERE'S WHY *ONLY* MOTOROLA COULD DO IT SO WELL

VERSATILE: Motorola produces the greatest variety of 2-way radio equipment available . . . portable, mobile and base station equipment were combined for the Mackinac Project to form a custom-made system at production line prices.

RUGGED: Motorola equipment is built to take the severe beating that any construction work imposes on it . . . to deliver when needed most. Motorola radio has been proven in use to *outlive* any other.

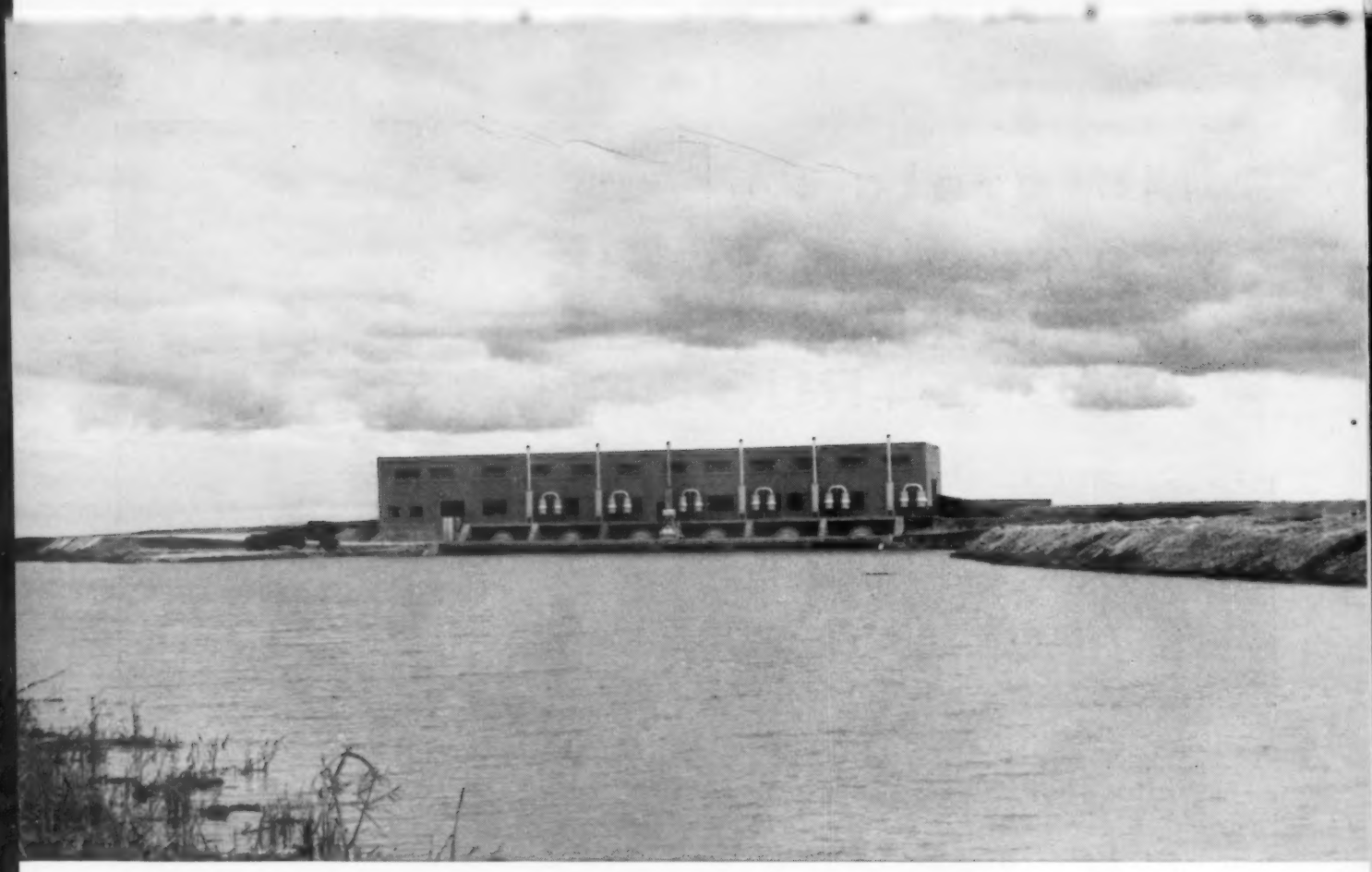
EXCLUSIVE FEATURES: The pioneer and leader, Motorola, offers more *exclusive* advantages and features than any other 2-way radio found anywhere.

SERVICE: A Motorola Service Station a few miles from the Mackinac Project stands ready for prompt, efficient maintenance. Motorola offers the most complete national service set-up—650 Authorized Service Stations, strategically located and on call 24 hours a day . . . assuring the fastest, most dependable service available.

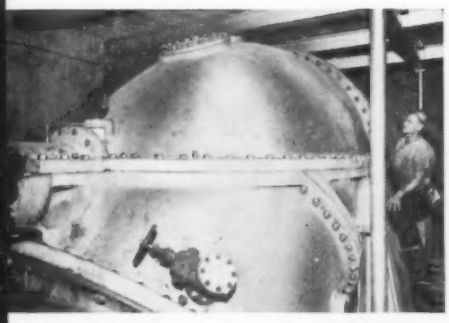
Motorola 2-WAY RADIO

Motorola Communications & Electronics, Inc.
A SUBSIDIARY OF MOTOROLA, INC.
4501 AUGUSTA BOULEVARD CHICAGO 51, ILLINOIS
ROGERS MAJESTIC ELECTRONICS LTD TORONTO CANADA

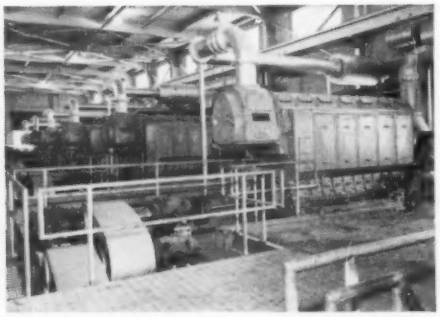
Motorola consistently supplies more mobile radio than all others combined—
proof of acceptance, experience and quality.
The only COMPLETE radio communications service—
specialized engineering . . . product . . . customer service . . . parts . . . installation . . . maintenance . . . finance.
"The best costs you less—specify Motorola".



World's largest pumping station tames Everglades



Each giant 89-ton pump is equal to the floor space of the average-sized living room. The huge four-bladed, air-foil propeller moves water through the pump at the rate of 360,000 gallons a minute.



Six 1600-hp. Fairbanks-Morse Opposed Piston Diesel Engines insure uninterrupted power for the big pumps, especially during storm periods when they will be most urgently needed.

Floridians who have counted their flood loss in thousands of lives and millions of dollars bitterly refer to Lake Okeechobee as the Killer Lake.

Now, with the completion of the world's largest self-powered pumping station, there is the promise of forever taming the Everglades' rampaging waters.

Located at the southern tip of the lake, the station houses six of the world's largest pumps . . . built by Fairbanks-Morse . . . powered by Fairbanks-Morse Opposed Piston Diesel Engines.

Each pump can deliver over 500 million gallons a day. That's more water than is consumed each day by the entire population of Florida. Put all six of these giant 89-ton pumps in operation and you can pump nearly three times the daily consumption of the city of New York.

We at Fairbanks-Morse are proud to be a part of one of the largest engineering projects on the face of the earth—and the country-wide acceptance it typifies. This endorsement and wide selection in the F-M line of 50,000 pump models assures you of finding the *one* pump best suited to your pumping requirements. When next you need a pump, look for the one made by the world's largest pump manufacturer—Fairbanks-Morse. Ask your nearby Fairbanks-Morse Field Pump Engineer for assistance on your specific problem, or write to Fairbanks, Morse & Co., 3601 Kansas Avenue, Kansas City, Kansas.

FAIRBANKS-MORSE

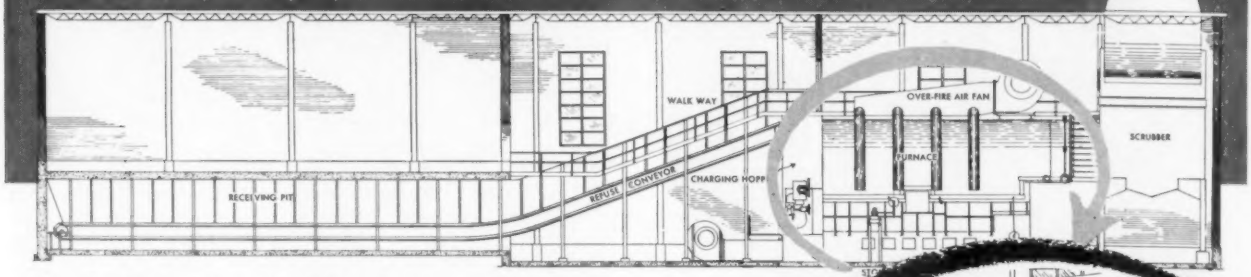
a name worth remembering when you want the best

PUMPS • WATER SYSTEMS • GENERATING SETS • MOWERS • MAGNETOS • MOTORS • SCALES • DIESEL LOCOMOTIVES AND ENGINES

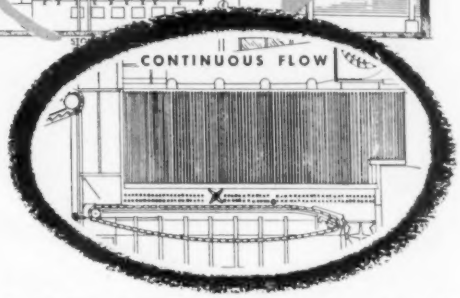
Thousands use our Readers' Service card to keep up to date . . . do you?

Combustors IS THE TRADE NAME for CONTINUOUS FLOW Controlled Incineration

TRADE MARK



Longitudinal section of building showing elevation of equipment in typical installation.



Combustors provides economical, trouble-free disposal of combustible refuse. Combustors provides the most efficient conversion of the available energy to hot water, steam or power . . .

For MUNICIPAL and INDUSTRIAL use

CONTROL—Combustors' Incineration features the continuous flow-type design with conveyors and traveling grates. The continuous and regulated flow of material from the Receiving Pit and through the furnace permits *Controlled Combustion, Controlled Temperature, Controlled Air* for combustion and *Controlled Cooling*, even though this material varies greatly in percentages of combustibles and moisture.

FLEXIBILITY—Combustors' design can be easily and economically coordinated into existing incineration facilities.

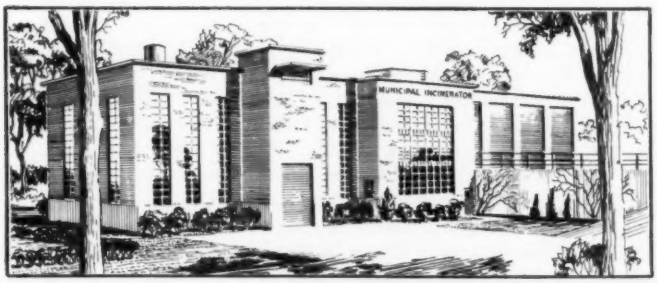
ANTI-POLLUTION—Combustors' system provides positive elimination of smoke, odors and fly ash.

LOW INITIAL COST—Combustors' design makes the initial costs of construction less.

LOW OPERATING COST—Combustors' continuous flow design and plant arrangement reduce the operating personnel.

LOW MAINTENANCE—Combustors' exclusive water-cooled furnace design eliminates high refractory costs.

LOW TOTAL FINAL COST—Combustors' low initial cost, low operating cost, low maintenance cost, and continuous flow design give Controlled Incineration at an exceptionally low final cost.



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Detailed information *will be gladly supplied by our engineers to Government, Municipal, or Industrial Officials, Consulting Engineers and Architects.*

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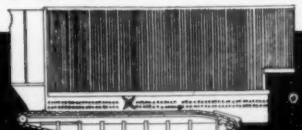

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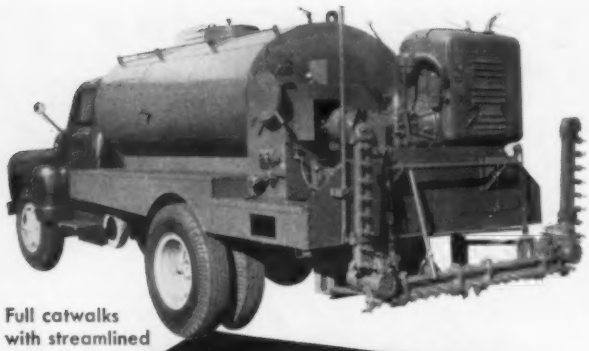

Full catwalks with streamlined skirting

State highway departments like

Abbreviated catwalk with tire flaps front and rear

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the first low cost distributor you can buy with just the right amount of equipment for your requirements . . . no more, no less. And with the new Model D you get ***your choice of 2 types of circulating spray bars:*** automatic or mechanical. Most important, the Spray Leader has the ***same operating system*** used in the more expensive Littleford distributors. If you need a good, basic distributor at the lowest cost, the new Model D Spray Leader is your best buy. Send today for free descriptive bulletin 14-D.

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PUBLIC WORKS ENGINEERING DATA

Relieving Truck Congestion on Uphill Grades

WILLIAM E. WILLEY,
Arizona Highway Department

(From a paper before the Highway Research Board)

Trucks and other motor vehicles were observed on US 89 between Wickenburg and Prescott, Arizona. The hill is four miles long with a continuous 6% grade and is known locally as Yarnell Hill. Data was recorded and points of greatest congestion were noted. It was determined from the analysis that followed that it would not be economically feasible to construct a full-length uphill truck passing lane. The benefit ratio was considerably less than one. The next step designated three passing bay areas, each 1,000 ft. in length, that were studied from an economic and congestion standpoint. The results showed that the passing bays could be justified and that with an expenditure of only 15%, of what a full-length passing lane would cost, it should be possible to relieve 70% of the congestion. Two of the bays were built and an after study disclosed that with a 20% expenditure it was possible to reduce congestion 65%. This and other studies along this line are directed toward the day when highway travel through mountainous areas may be safe, convenient and without unnecessary long delays behind slow moving vehicles. The day of the uphill passing lane as an integral part of modern highway design has finally arrived.

How Texas Promotes and Conserves Wild Flowers Along Roadsides

Since wild flowers cannot exist under heavy grazing or in cultivated fields, the Texas highway rights-of-way are fast becoming sanctuaries for many of the state's most beautiful flowers. The Highway Department includes preservation of these species as a regular part of its maintenance and betterment program—protecting them where they are already established, seeding new areas, and reseeding where they have died out.

To gardeners who are accustomed to buying seed in 15-cent packets or by the ounce, the Department's methods of harvesting seed is something to see. Seed sources are located during the blooming season, and are carefully watched so that seed may be obtained at the proper stage of maturity. The Department has found that the most successful and least expensive method of obtaining the large quantities of seeds needed is mowing the wild flowers with power mowers. As soon as the seed-laden flower stems have been cut they are immediately hauled

BLACKHAWK TRENCH HOG

VERSATILE
ACCURATE
FAST
LOW COST

Ideal trencher for scores of jobs:

FOUNDATIONS
SERVICE LINES
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Here's the handiest machine you ever owned —a fast, low priced, mobile tractor-mounted trencher for utility lines, foundations, sewer systems, septic tanks, etc. You'll find this ladder-type trencher working all the time. Cuts 6″ to 20″ wide trench down to a depth of 7′. Average digging speed 350′ to 400′ per hour — digs up to 800′ per hour. Cuts through all soils the year 'round. Special chisel type cutters for rocky or frozen ground. Independent control of each drive wheel assures exact and easy regulation for either straight or curved trenches. Mounts on Ford or Ferguson tractor — easily driven from job to job — one man operated. Bull-dozer blade available for backfilling. Write for all the facts today.

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PRODUCTS FOR BETTER FARMS, BETTER INDUSTRIES SINCE 1920

BEAT YOUR MAINTENANCE COSTS with GRACE "EZ-ON"® TRAFFIC SIGN FACES

. . . IN THE NEW RED or YELLOW

GIVE SAME SERVICE AT THE ORDINARY COST! 1/2

You save real money, about half...if you use 'EZ-ON' Faces that slip on right over your present signs. Same high quality and they're reflectorized. In quantities **AS LOW AS...**

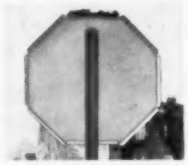
$2.80 EACH

APPLIED TO SIGN ON LOCATION SAVES REMOVING SIGN TO SHOP

Now in the new RED (or Yellow as you may prefer), 'EZ-ON' Faces restore your old, defaced signs on location in less than 5 minutes! NO EXPENSIVE EQUIPMENT NECESSARY. Save time, save labor costs. Your maintenance problem is thereby solved!

THEY FIT OVER PRESENT SIGN
ATTACH IN LESS THAN 5 MINUTES!

1. Slip 'EZ-ON' Faces over old sign. Note wide flanges.



2. Then bend flanges backward holding 'EZ-ON' Face in place.

3. Use special Crimping tool to clamp flange and secure sign.

STANDARD COPY or YOUR OWN

They're made of 30 ga. steel and in 2 shapes and 2 sizes, as shown above. Any standard copy..warning or regulatory or your own copy...as you may prefer. 'EZ-ON' Faces are solving the maintenance problem in many states and cities throughout the nation. Why not in yours?

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Solve your water problems with THE RANNEY METHOD
The latest techniques and a new scientific approach now solve the problems of ground water flow and infiltration. Our Hydrogeological Division can determine, the dependable capacity of each Ranney horizontal water collector system prior to construction.
Why absorb costs and inefficient returns from your old water collecting operation? The RANNEY METHOD requires less personnel, cuts operating costs, and eliminates costly filter plants. . . . Write now!
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to and distributed thinly over the area to be seeded.

Desirable areas along highways for wild flower seeding programs include the outside of curves, cut slopes, approaches of structures, at intervals on long tangents, median strips dividing traffic lanes, areas at intersections, approaches to cities and towns, parks and turnouts, along streams and water fronts, and historical places. Wild flowers already growing in the area are best to use since it has been shown that they will flourish in that particular type of soil. Experiments are constantly carried on however, in an effort to encourage a wider distribution of a given species.

Controlling Expressway Traffic by Television

Television control of expressway traffic is being considered by Detroit's streets and traffic department. Television cameras would be stationed along the highway so that long stretches of automobile traffic could be viewed. With monitors at a central location, an observer would operate electrically the warning signs for motorists, who then would leave the expressway in case of traffic tie-ups.

A Comparison of Public vs. Private Ownership of Water Utilities

In a paper before the Rocky Mountain Section of the American Water Works Ass'n. describing a privately owned water works for Thornton, Colo., S. J. Joseph, Vice-President and general manager of the company, made the following comparison between public and private ownership of utilities.

"Although publicly owned utilities enjoy tax advantages and can generally establish rates and regulations without reference to a public utilities commission, the privately owned company is favored by a number of other aspects. Perhaps the greatest is the freedom of operation management enjoys. All decisions are made by management, which is accountable to a board of directors rather than to a political body. In regard to financing, bond elections are not required, so that a minimum of time is lost. Although higher rates of interest may be paid, they are more than offset by efficiency of operation. Red tape is reduced. Plant designs are strictly utilitarian and are as automatic as they can be made within economic limits, permitting operation with a minimum of personnel and a maximum of efficiency. A privately owned company cannot carry any dead weight. Hiring and firing do not involve politics.

"Supplies and materials for private utilities are purchased by an individual rather than by a board. Some communities and states give local business a 5 percent preference over outside vendors. Private utilities, which can purchase anywhere at the greatest savings, invariably seek cost advantages. Standardization of equipment, such as water meters, pumps, and the like, can be maintained, reducing inventory investment in maintenance supplies and providing the benefits of interchangeability of parts. At times it may be found that a standardized item may cost a little more than a comparable nonstandard one, but the ultimate cost is less when maintenance and repair are considered, because the personnel are familiar with the standardized item and time is saved. Moreover, the purchasing board of a publicly owned utility has to accept the lowest bid as long as the specifications are met, although the result may be greater operating costs."

Two SURE FIRE Ways to Please Taxpayers

GoodRoads LEAF COLLECTOR *GoodRoads* SCAVENGER

For *Most Efficient* Leaf Collection and Rubbish Clean-Up

No need for your constituents to complain about dirty streets or messy accumulations of leaves or other debris on roadways, sidewalks, parks or other public grounds. The two units illustrated are designed specifically to keep these areas clean—and to do it quickly, economically, efficiently.

LEAF AND LITTER COLLECTOR

The Good Roads Leaf Collector with "Tornado power" cleans up leaves, litter and debris like magic. Wet or dry, loose or compact, makes no difference. It reaches around and under parked cars and any other hard-to-get-at places—no sweeping, no dirt, no mess. Only two men—one driving the truck or tractor and one handling the suction tube—can do as much work in a day as ten or more with other equipment. Leaves are pulverized and deposited in the 14 cu. yd. hopper. The compacted "packaged compost" is readily dumped by hydraulic action wherever fertilization is desired.

MOTORIZED SCAVENGER

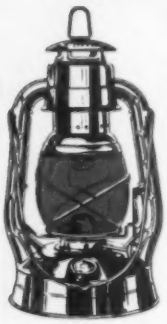
The Goods Roads Scavenger works like a giant heavy-duty vacuum cleaner—picking up all kinds of debris and rubbish on roadways, parks, picnic and recreation gounds, golf courses, cemeteries, etc. Bottles, cans, papers, rags, cartons, leaves, twigs—wet or dry and almost regardless of size and weight—are whisked into the 12 cu. yd. hopper with ease. When filled, the hopper can be quickly emptied by its own hydraulic self-dumping mechanism. The operator rides in a comfortable seat to direct the suction tube. Convenient push-button buzzer signals the tractor or truck driver.

Don't wait for "Clean-up Week." Keep your public areas clean and your taxpayers happy at all times with Good Roads Leaf Collector and Scavenger. Write for complete information to GOOD ROADS MACHINERY CORP., MINERVA, OHIO.

Need more facts about advertised products? Mail your Readers' Service card now.

DIETZ

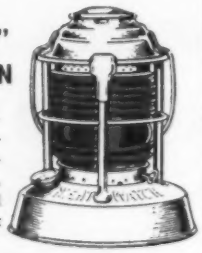
HIGHLIGHTS of SAFETY for the HIGHWAYS and BYWAYS



DIETZ TUBULAR LANTERNS

RED says DANGER — DIETZ LANTERNS say STOP. A complete line of economical, long burning, ruggedly made kerosene lanterns available with Ruby, Clear, Blue, Green or Amber globes, backed by the world's largest and oldest makers of portable light.

DIETZ "NIGHT WATCH" SAFETY LANTERN



A miniature beacon — with "Pencil Beam" — visible from any direction, near and far. Longest burning — well over 100 hours on pint of kerosene.

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"Magnified-Beam" seen for great distances. Wide, non-tip base. Long burning, economical. Stands rough usage.

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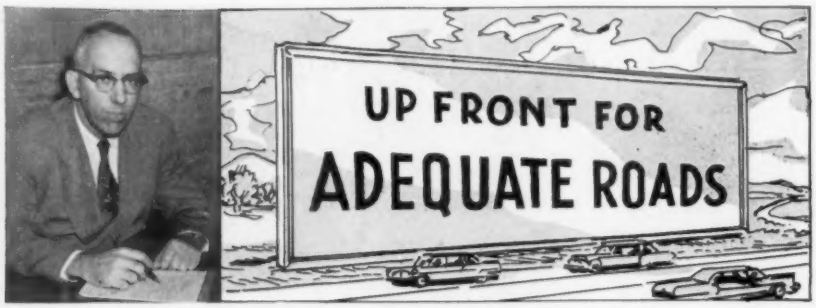


by LEO J. RITTER, JR.

Dense Graded Aggregate Base Courses in Virginia—Among the papers given at the ARBA meeting in New Orleans last January was an interesting one entitled "Dense Graded Aggregate Base Course Construction" by A. B. Cornthwaite of the Virginia Department of Highways. The report describes the relatively new use of dense graded aggregates, prepared in a central mixing plant, for bases in that state.

The coarse aggregate used in the mixture is required to be composed of hard, durable particles of crushed stone or slag, with maximum permissible loss in the Los Angeles Abrasion test being 43%. The grading of the aggregate-soil mixture is as follows:

Sieve	*Total % Passing*
2-inch	100
1-inch	65-95
3/8-inch	50-75
No. 10	25-45
No. 40	12-30
No. 200	5-20

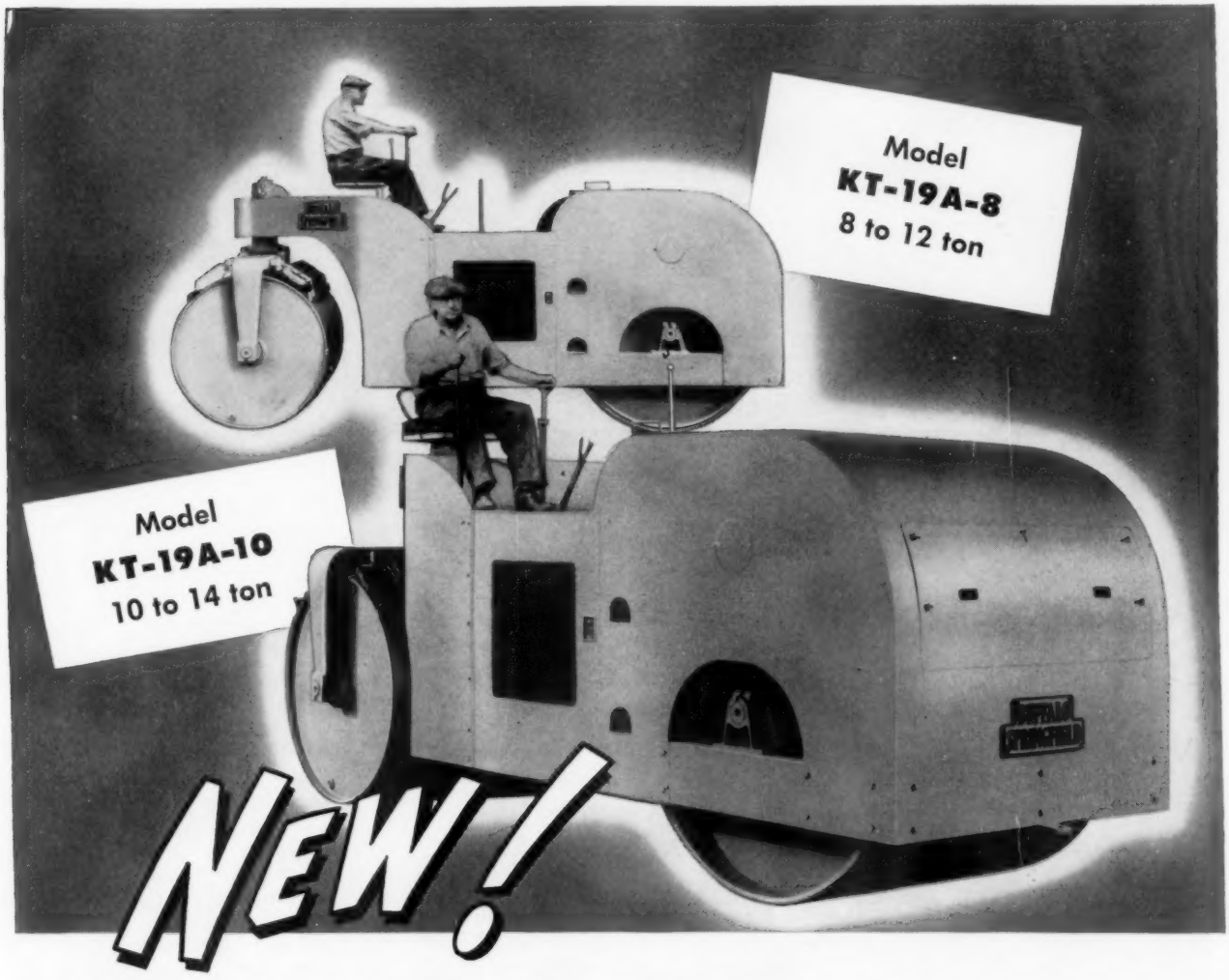
In addition, the amount passing the No. 200 is not permitted to be more than 2/3 of the fraction passing the No. 40 sieve. Also, the portion passing the No. 40 sieve can not have a liquid limit greater than 25, nor a plasticity index of more than 6.

The crushed stone and soil mortar are blended in a central mixing plant, using either batch or continuous type. Water is incorporated in the plant to bring the moisture content up to optimum, as is calcium chloride, generally at the rate of 7 pounds per ton of mixture. The properly blended material is then spread on the prepared subgrade, using mechanical spreaders having "V" type screeds, and to a depth of no more than 4 inches (compacted depth). Compaction is carried out by straight-axle, pneumatic rollers, working in conjunction with steel-wheel rollers. Density requirements are 100% Standard AASHO maximum density. The placing of additional courses, after the first one, is normally done on the next working day. Vibratory compactors have also been used successfully in this type of construction.

Mr. Cornthwaite's conclusions, after much more detail about the method, are " . . . the graded aggregate base can be designed to provide pavements of the highest order—and for the heaviest traffic normally encountered on highways. It provides a quick construction project, competitive in price, performance and convenience to other types of pavements. The equipment advantages, labor, time and weather advantages, are highly regarded by the contractors. Last, but by no means least, a riding surface second to none can be built which provides both comfort and safety."

Fading Hopes — It looks as though President Eisenhower's "grand plan" for a $101-billion, ten year highway program will die a hard, but not violent, death in the present Congress. Practically doomed from the start by Democratic opposition and a belated and hesitant presentation, the plan will undoubtedly be replaced by a simple increase in the present federal-aid program; look for federal aid to be raised from the current $875 million per year to perhaps $1.25 billion. Principal objections to the original plan—based on the Clay Committee report—are the financing aspects, including the sale of bonds and interest costs over the ten-year period, and fear of increased control over the nation's highway system by the federal government.

Big Town—The big town has big plans for highway and bridge construction, as reflected in the recent joint report of the Port of New York Authority and the Triborough Bridge and Tunnel Authority, which recommends a construction program of $379 million over the next 5 years in the New York-New Jersey metropolitan area. The report is the result of a joint study



BUFFALO-Springfield announces line of STANDARD TANDEM ROLLERS

These new STANDARD Tandem Rollers are designed especially for low-cost handling of any compaction job where pressures of from 8 to 14 tons are required.

Included as standard equipment is a heavy-duty, single-stage torque converter* that automatically matches power and speed to the material and grade variations of the job.

Without gear shifting, drivers can operate these rollers at any selected speed from 1 to 5 mph with the engine running continuously at its most efficient and economical power peak (2-speed mechanical transmission also available as optional equipment).

The heavy-duty, industrial-type engine (diesel or gasoline optional) delivers dependable power under all kinds of operating conditions. Buffalo-Springfield's widely-known bevel gear and final drive assembly offers the advantages of unusually low gear tooth bearing pressures, results in less wear, and is easy to adjust when required.

The massive, all-welded frame is heavily reinforced to maintain rigidity over a long operating life. Control instruments and levers are conveniently located to simplify the operator's job.

Ask your nearest Buffalo-Springfield distributor to tell you all about the new STANDARD Tandems. Dollar-for-dollar, feature-for-feature, they can't be matched by any other rolling equipment available today. Write for the new illustrated Bulletin No. S-68-555.

**Buffalo-Springfield has offered torque converter power since 1951.*

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MACADAM CONSTRUCTION: All around the country on major paving projects the JACKSON VIBRATORY COMPACTOR is being hailed as the most advantageous equipment ever developed for achieving specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Uniform compaction to final density is obtained in rock macadam courses up to 12" in minimum time. The dry fines are quickly vibrated into all voids, filling them chockfull, solidly, from top to bottom of the course. Standard width is 13',3". Working speeds up to 60 FPM, reverse travel: 5½ MPH.

SUB-BASES, GRANULAR SOIL-CEMENT PAVING and SAND FILLS: It is equally efficient on gravel sub-bases and granular soil-cement paving or base course construction. And it's a bear-cat for compacting sand fills such as bridge approaches, since it quickly achieves desired density and individual units may be subtracted and even fitted with operating handles to suit every condition and to get into the really tight places.

PAVEMENT WIDENING: In any granular material used in flexible base course widening specified density is accomplished in one pass with the compacting units towed in tandem at the side of the tractor. Interchangeable bases from 12" to 26" wide may be substituted for standard 26" bases to suit requirements.

By all means investigate this time and money saving equipment

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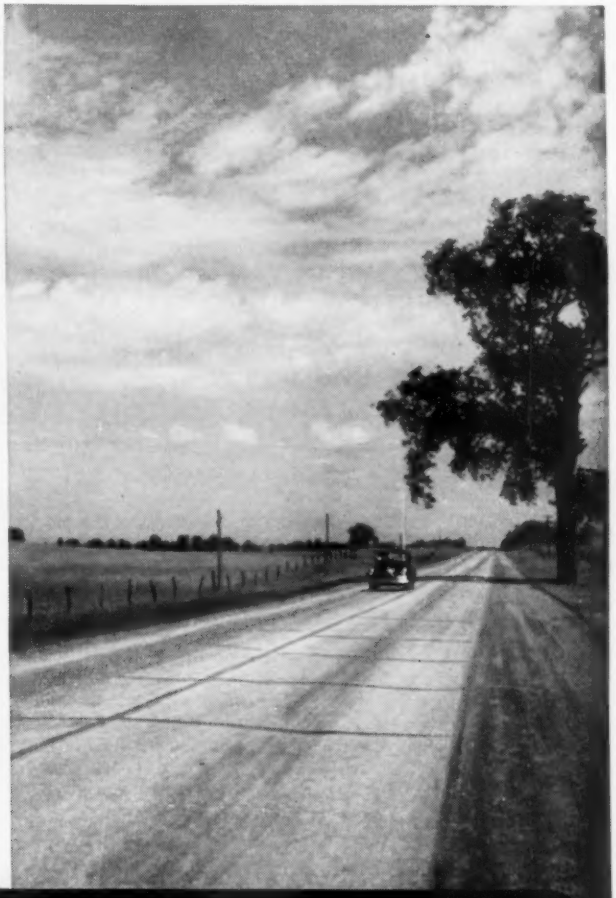
begun over a year ago. The recommendations include a 12-lane, double-deck suspension bridge across the Narrows, connecting Fort Hamilton in Brooklyn and Fort Wadsworth on Staten Island. Also included are a six-lane lower deck on the George Washington Bridge, a new Throggs Neck Bridge, connecting Cryders Point in Queens and Fort Schuyler in the Bronx, and an extensive system of connecting highways beyond the immediate bridge approaches. Target date for completion of the program—1960.

Training Program—A recent issue of *Highway Highlights*, the monthly magazine published by the National Highway Users' Conference, carries a report by W. L. Haas of the Wisconsin State Highway Commission concerning the training program being carried out by that organization. This program, inaugurated in March, 1953, provides intra-organization training in highway engineering for young graduates. In two years, 55 young engineers have participated in the program, which is carried out in the various districts and the central office in Madison. Only 6 of the total enrolled have dropped out in the two-year period, a fine record. Last year—as a part of Wisconsin's general program of training and as one of the steps being taken to provide more technical help for professional engineers in the organization—40 high school graduates were screened by civil service procedures and given an intensive training course, in which the University of Wisconsin cooperated. These men were then returned to the districts, where they serve as engineer aides.

Reports—Three important reports dealing with highway matters are due to be transmitted to the Congress soon, all as a result of provisions of the Federal-aid Highway Act of 1954. One of these is the report on a comprehensive study of all phases of highway finance; more specifically, the study includes examination of the cost of completing the several highway systems and of the feasibility of toll roads with particular attention to their effects on the federal-aid highway programs. A portion of this study has already been made public. Another is the report on problems posed by the relocation of public utility services resulting from highway improvements. The third report will deal with the "codification" of the various federal-aid laws enacted over



There's Pay Dirt in Mud Roads When You Pave with *SOIL-CEMENT*

Taxpayers and motorists strike real pay dirt when old mud roads and streets are transformed into soil-cement paving. The old mud itself becomes all-weather paving simply by mixing in small measured amounts of portland cement and water.

Soil-cement paving is low cost because it requires less material and hauling. It utilizes the soil already on the road site. This usually constitutes about 85 per cent of the necessary material. Normally only cement, water and bituminous surface material need be trucked to the job.

Soil-cement paving is also low cost because it is *fast*. Regular construction and maintenance crews quickly can be taught the simple methods of building dependable, long-lasting soil-cement pavements. And needed construction equipment is either already on hand or can be readily obtained.

Soil-cement is not only low cost but also *easy* to build. Scientific testing methods in the laboratory and on the job remove all the guesswork and make paving procedures entirely foolproof.

And, more pay dirt, records show that maintenance costs for soil-cement paving are extremely low.

Why not make this "pay-dirt" method the basis of a dependable secondary road and residential street paving program? Send for free illustrated bulletin on soil-cement road and street construction and maintenance. This literature is distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

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Solves Brush Disposal

Instant brush disposal—right on the spot! That's why so many leading power companies, municipalities, utilities, and tree surgeons now cut disposal costs—chip brush, branches, trimmings with powerful Fitchburg Chippers. Eliminate hauling, burning—with its fire hazard, extra labor, inconvenience. No waiting. Chip in any weather, wet or dry. Here's a clean, acceptable method of disposal that wins public approval and good will.

Saves You Labor

Read what users say. From a Missouri utility line clearance firm: *"One man can operate the chipper with ease. He alone can handle as much and more brush in the same length of time as could two men loading brush on a platform body."* From a Connecticut tree expert: *"This chipper has cut our brush disposal in half. It has eliminated brush dumps and fires completely."* One large Ontario power customer reports a saving of 25% in man hours expended per tree as a result of equipping their crews with Fitchburg Chippers.

Increases Your Production

In Oregon the Roadmaster for one county said: *"This Fitchburg Chipper has paid for itself twice over the first season."* Another chipper user on Washington State Highways reports that with a crew of three men they can clean up at least a half mile of heavy brush in six hours. A Missouri utility line clearance firm says: *"Our figures show that production has been increased by a good 25% with a Fitchburg Chipper."*

Stays Out of the Shop

Read what satisfied users say. Connecticut: *"The Fitchburg Chipper has never cost us one minute of delay."* Ohio: *"We now have ten of your Fitchburg trailer type chippers. Doing a good job—from the looks of them they will last for many years."* New York: *"Our men are particularly pleased with Fitchburg Chippers. They are rugged and reliable."*

FREE BOOK GIVES FACTS

READ the actual letters from which the quotations above were taken. Free, colorful, Fitchburg booklet gives full data and specifications—gives actual names, companies, places. Send for it now—it's free.

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Please send Fitchburg Chipper booklet.

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the years, including recommendations for changes or new provision in future laws. It is reliably reported that the report probably will recommend repeal of the federal prohibition on diversion, which is a section of the Hayden-Cartwright Act of 1934.

Musing—We've been looking over the monumental report entitled "The Highway Construction Industry in a Ten Year National Highway Program", just published by the American Road Builders' Association. This booklet presents the reports for the four "task forces" of ARBA, who undertook the evaluation of the ability and readiness of the engineering profession to plan, design and execute a program to eliminate the $101 billion deficiencies in the nation's highways in a period of ten years. Portions of the report deal with planning and design, materials and supplies, construction, and construction machinery and equipment. It makes interesting and informative reading, bringing home again the tremendous scope, importance, and ability of the highway industry in this country. Incidentally, nobody in ARBA has any doubt that the job can be done, if only the money were available.

Names in The News — Louis S. Rothschild, former chairman of the Federal Maritime Board, recently became Under Secretary for Transportation in the Department of Commerce. Harry C. Coons, Deputy Commissioner and Chief Engineer of the Michigan Highway Department, died suddenly February 16. Joseph M. Lawler has been named Secretary of Highways in Pennsylvania, replacing E. L. Schmidt. Alan M. Williams, engineer-superintendent of the road commission of Ionia County, Michigan, has been elected president of the county and local roads division of the American Road Builders' Association. Walter A. Rugan has been named Director of Highways for Kansas, succeeding Gale Moss.

Blackout—We hoped to give a few words this month about what's going on in California, but we can't. Our copy of *California Highways and Public Works* arrived; that is the cover arrived, sans contents. Wonder if the postoffice is censoring technical publications these days.

Thither and Yon — A preliminary accident summary report recently

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GULF SANI-SOIL-SET is the practical answer to your dust annoyance problems. Here are a few of the many good reasons why it will pay you to investigate this efficient dust-control medium now:

HIGHLY EFFECTIVE—Gulf Sani-Soil-Set eliminates dust annoyance completely immediately after application. No long waiting periods are necessary before the ground is ready for use. The dust allaying effect is accomplished by the action of the compound in adhering to and weighing down dust particles.

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In St. Louis
2 rubber-tired units spread, compact and cover 100 truckloads of trash daily
One Tournatractor and one D Tournapull easily spread and cover 100 five-yard truckloads of trash a day at a private sanitary landfill operated by Harold Macoy, Jr., president of the St. Louis Sanitary Landfill Company in St. Louis, Missouri. This corporation specializes in sanitary landfill. They handle the operation in this way:
Trucks, ranging from 5 to 30 cubic yards in capacity, dump all types of refuse including garbage. The Tournatractor, weighing over 33,000 lbs., dozes and compacts it under 28 lbs. per square inch pressure. When trash layer gets a few feet deep, the 7-yd. Tournapull, either self-loading or push-loaded by the Tournatractor, hauls and spreads a dirt cover. When the layers of trash and dirt reach 24 ft. deep, a final 2 ft. cover of dirt is brought in, and dumping extended into another area.
Although the landfill is open 24 hours a day, 365 days a year, this LeTourneau-Westinghouse team, working less than 5 hours a day, covers all rubbish with ease. Immediate clean-up and covering prevents odors, fly and rat breeding and fires or smouldering . . . eliminates any community nuisance. Contractor saves money, too, through low equipment inventory, and the city benefits through simple, economical disposal of a large portion of its trash. Equipment owner Harold Macoy formerly used 2 crawler tractors, a dragline, and 2 trucks for this work, but the crawlers were too slow, compaction was inadequate, and clogging of tracks with wire and trash caused excessive downtime. Mr. Macoy says: "My Tournatractor and 'D' can handle all of St. Louis commercial and industrial trash in all kinds of weather."
Other communities have solved their rubbish or garbage disposal problems in a similar way. In smaller cities, D Tournapull, equipped with dozer blade and working alone, spreads refuse, digs trenches, hauls, and spreads cover. In other municipalities, Tournatractor pulls a scraper to dig trenches and haul cover.
With either high-speed LeTourneau-Westinghouse machine —city-owned or under private contract—your community can have clean, sanitary rubbish disposal without the eye-sore and odors of an open dump. Get facts from your LeTourneau-Westinghouse Distributor.
Also uses D Tournapull
Macoy also uses 7-yd. D Roadster Tournapull to bring in cover for refuse. Rig is powerful enough to self-load, yet has ample capacity for push-loading.
LeTourneau-Westinghouse Company
PEORIA, ILLINOIS

released by the National Safety Council estimates that 36,300 lost their lives in highway accidents in 1954. This is the lowest figure since 1950, and represents a rate of 6.5 fatalities per 100 million vehicle miles, compared with a rate of 7.1 in 1953 and 7.4 in 1952. Texas has hit the headlines with inauguration of construction on its two big toll road projects—one which eventually will extend from San Antonio to Waco to Dallas (246 miles) and the other from Dallas to Houston 233 miles). The unique thing about the Texas projects is that they are being built by private turnpike authorities. The Department of Traffic of the City of New York has installed its first electronically controlled traffic light—by which the volume of traffic sets the signal timing—at the intersection of Franklin D. Roosevelt Drive and East 96th Street. One of the largest metropolitan rubber-type street resurfacing projects in the country has been completed in Rapid City, South Dakota.

• • •

Savings From Dust

The history and result of Colorado's experience with Cottrell Dust in improving road bases in areas where stable sand and gravel are not available were detailed by the State Highway Department's Concrete and Aggregates Engineer, Burrell B. Gerhardt, in a paper on "Use of Cottrell Dust to Improve Sub-Standard Base Course Aggregate," which he presented at the Annual Highway Conference at Boulder in February. Cottrell Dust is a by-product of the manufacture of cement.

The State Highway materials laboratory has made exhaustive analyses of Cottrell Dust and checked its likenesses to and differences from ordinary cement dust. "Cottrell Dust has improved the quality of many inferior base course materials" said Gerhardt, citing examples of its use on a county road north of Kiowa.

"Base courses on about 60 miles of both light and heavily traveled roadways in Colorado have been constructed of sand and gravel treated with three percent Cottrell Dust. To date their performance has been satisfactory," Gerhardt said. He concluded, "To put it in a nutshell, one might say that Cottrell Dust won't do anything that cement won't do, but three percent of it blended with sub-standard base course material behaves so much like three percent cement that for four dollars a ton, Cottrell Dust is an attractive mixture."

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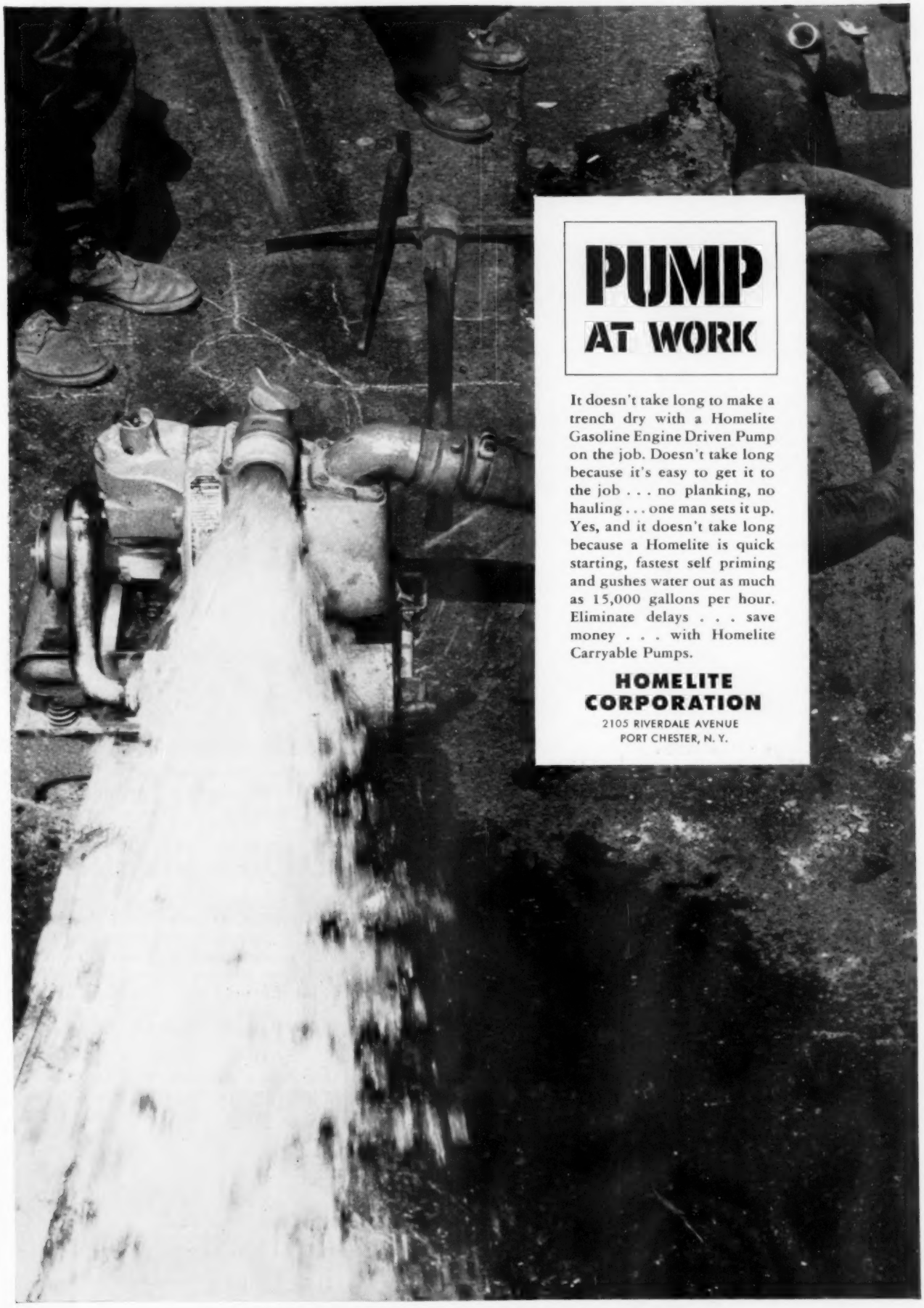
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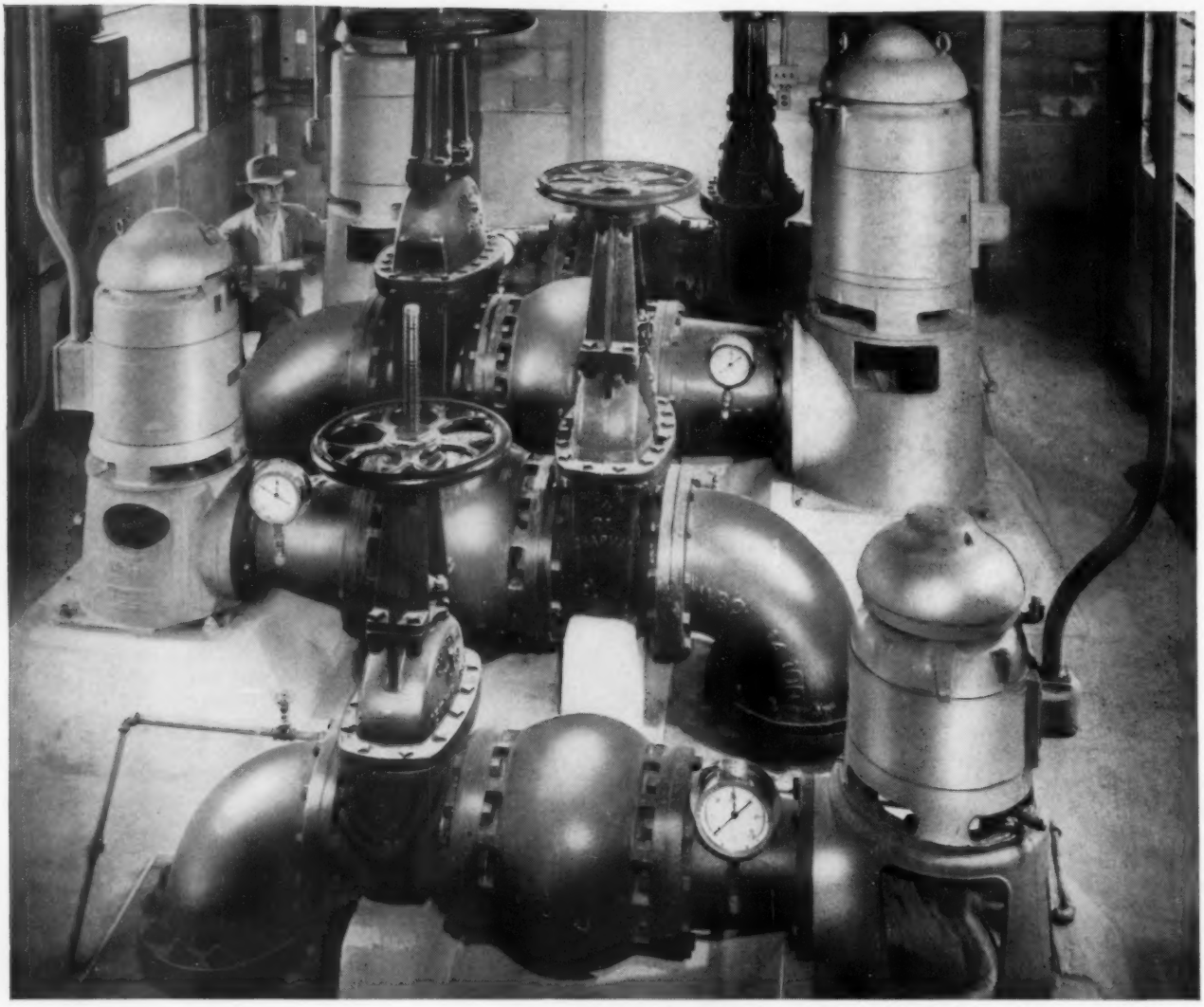

FOUR WORTHINGTON VERTICAL TURBINE PUMPS deliver 14,500 gallons of water a minute to reservoir serving Van Wert, Ohio.

Versatile is the word for these pumps

Interesting thing about this new pumping installation for the city of Van Wert, O., is that four Worthington vertical turbine pumps, usually used for deep-well service, are delivering water from a shallow creek.

This type of pump was recommended after consultation with Van Wert engineers because it needs no priming devices, suction lines, or dry-pit construction. Moreover, its vertical design takes up less space than other types. The Worthingtons have proved a wise choice — they're highly efficient, their operating cost is remarkably low, and maintenance is practically nil.

We can help with *your* pumping problem, too. Just how, is made clear in our Bulletin W-450-B40. Write for it. Worthington Corporation, Vertical Turbine Pump Division, Section D.4.30, Succasunna, New Jersey, or Denver, Colorado. D.4.30

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...AT LOWER COST
with our
WHITE 3000 Fleet"

...L. E. BROWN
Department of Sanitation
CITY OF RENO
Reno, Nevada

Newest of the nine Whites is a Model 3022 with 16-yard packer. It has double-reduction rear, low-speed transmission, 11.00 x 20 road lug, puncture-proof tires.

ANOTHER WHITE 3000 has been added to the City of Reno Department of Sanitation fleet.

And it's easy to see why. Residents never had it so good! There is 7-day-week service . . . downtown area cleared by 5:30 a. m. . . . special trash collections, too.

The crew likes it, too! Steps and lifting saved. Hours better. Roomy, comfortable cab. Driving ease. Safety.

And, best of all, operating costs are low, overtime practically eliminated, and Reno has the reputation for being the "cleanest city in the West". Whites are rugged and tough, too. Fleet average is 200,000 miles and still rolling up the miles.

Get all these advantages with the White 3000. See your White Representative without delay.

THE WHITE MOTOR COMPANY
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SAVE TIME ON STREET FLUSHING, TOO!

This White 3000 in street flushing service is another Reno specialty which wins wide favor. Maneuverability of the WHITE 3000 saves time.

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Save up to 60% of floor space

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JOHNSTON Vertical Turbine PUMPS

and reduce maintenance and operating costs!

Here is why rugged, economical Johnston Vertical Turbine Pumps are used for municipal water supply by the City of South Gate, California and are preferred by experienced municipal engineers everywhere. Vertical design saves up to 60% of floor space. They fit in tight places where space is at a premium. No need for costly priming devices—Johnston Pumps can be installed to start and stop easily and require no priming. Low maintenance and operating costs—measured dollar for dollar per year of service, make Johnston Pumps the most economical you can buy. The Johnston dealer in your area will gladly confer with you on your pumping problems. Write for details.

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PWM-55

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FOR

• PUBLIC HEALTH
• INDUSTRIAL EXPANSION

WACO, TEXAS

specifies

CLAY PIPE

More than 32 miles of Clay Pipe in sizes from 6 to 24 inches are being installed in Waco, Texas, as part of that city's $5 million bond-financed sewer improvement program. Clay Pipe is helping to solve two of the city's most urgent problems:

PUBLIC HEALTH When the city was alarmed by a polio outbreak in the neighborhood of an orphanage, investigation showed that breaks in an old non-clay sewer pipe allowed sewage to flow into a creek bordering the institution. Medical authorities suspected a connection between the polio epidemic and the sewage overflow. Clay Pipe was installed as a public health measure.

INDUSTRIAL EXPANSION. In two huge new industrial areas opened by the Waco Industrial Development Association, Clay Pipe was used exclusively to handle the chemicals, dyes, acids, and other corrosives commonly found in industrial sewage.

In other sections of the city, acid soils made Vitrified Clay Pipe a "must." There's no safe substitute for Clay Pipe. *It's guaranteed for 50 years.*

City officials directing the project include Mayor H. F. Connally, Jr., City Manager Jack Jeffrey, and City Engineer Eugene Shields. Private Contractors: J. D. George & Co., Rogers Smith Construction Co., and Parks and Andrews.

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PIPE

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C-455-1

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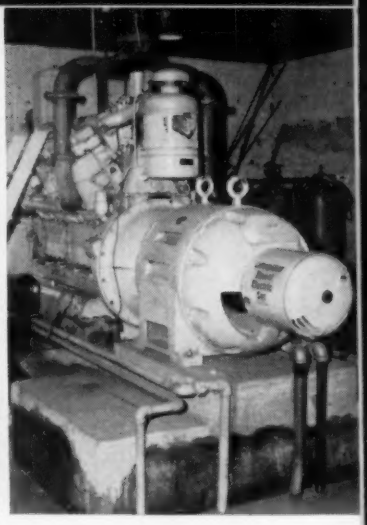
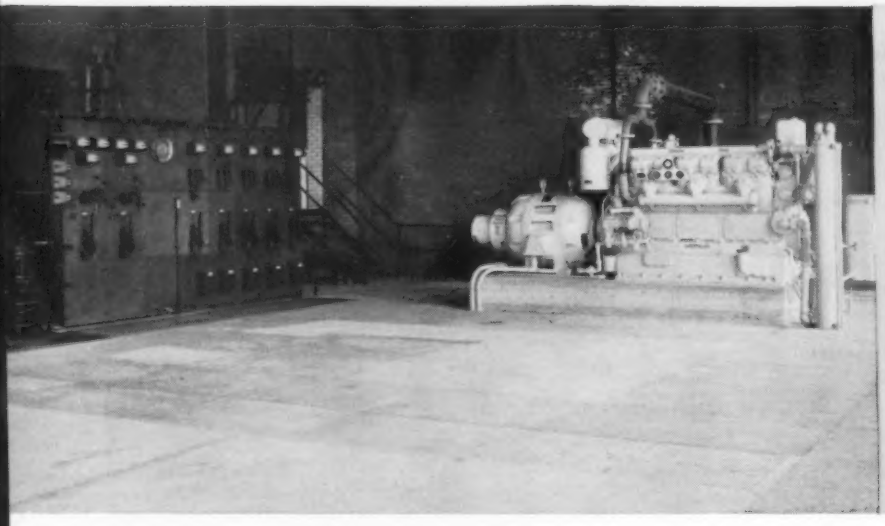
HOW PARSONS GETS RELIABLE, COMPACT STANDBY POWER

This is the Neosho River pumping station near Parsons, Kansas. Parsons' water supply comes from here—nine miles from town and up a 97-foot rise. Normally, city power keeps the station's 3½-million-gallon-per-day pump going, but when there's an emergency quick power is supplied by a Caterpillar D364 Diesel Electric Set (right). The 1951 flood buried this D364 beneath four inches of mud; after only a thorough cleaning, it worked perfectly again.





From the river station, Parsons' water comes through this downtown processing plant. Here, too, a dependable CAT* Electric Set stands by. Note this D397's neat, compact installation. Formerly a pair of steam boilers with generators stood here, filling the room with machinery. 3½ million gallons of water a day are processed here during peak summer periods. That's why Plant Supt. C. A. Brewer says, "We need an installation that'll get going and keep going. Our Cat equipment does just that."

Caterpillar Diesel Electric Sets and Engines are available to 315 KW and 520 HP. They're easy to install (no need for cranes, for instance), convenient to service, and—above all—reliable. Ask your Caterpillar Dealer to show you how these features add up to low-cost insurance. And remember, your dealer stands by, too—with trained engineers to help you plan and complete your installations. Call him for details.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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MODERN HEAVY-DUTY DIESEL POWER

PUBLIC
WORKS
May, 1955

REHABILITATING

Old Concrete Pavements to get a

SECOND GENERATION OF SERVICE

JOHN H. SWANBERG

Engineer of Materials and Research,

Minnesota Department of Highways

DURING the early history of the Minnesota Department of Highways when the volume, weight and speed of traffic were much less than they are today, approximately 600 miles of 18-ft. concrete pavement were built. Since then age, climate and service have taken their toll and it became alarmingly evident a number of years ago that steps would have to be taken to rehabilitate those roads to meet the challenge of modern traffic.

● WIDENING: After the widening trench has been dug, the next step is spreading the bituminous base material in it.

● ROLLING: Here a special roller is being used to compact the granular base material before placing base course.

The necessity for improvement was dictated by inadequate width, deterioration of the pavement as evidenced by surface disintegration, cracking, scaling, spalling, faulting, heaving and warping and in some cases by the need or desirability for realinement or correction of vertical sight distances. Because of lack of knowledge or appreciation of the part that soils and foundations play in the performance of highway surfaces many miles had been paved over subgrades providing inadequate support, which became a major factor in the deterioration of the pavements. But deterioration or not it was a necessity that measures be taken to bring those highways up to modern standards of width, alinement and curvature, both vertical and horizontal, to accommodate modern high speed traffic, and to do this as part of a planned program.

Beginning in 1936, the Maintenance Division initiated a number of bituminous resurfacing projects primarily to improve the riding qualities and arrest the progressive deterioration of the surface. Maintenance costs had become a serious item on some of these projects. Thicknesses of the bituminous surfaces ranged from 1½ in. to 2 in. and the mixtures, which were plant-mixed or pre-mixed road mix, were usually placed by the conventional mechanical spreaders although some work was done by blade methods. In some cases the pavements were widened with gravel base, usually on each side, to accommodate a wider riding surface. These rehabilitation projects were substantial improvements and the expenditure appeared to be well justified.

In 1938 the first major pavement reconstruction project was let by contract. It was approximately 12 miles in length on one of the major trunks of the state and involved the widening and resurfacing of an old 18-ft. pavement to serve as the major portion of a double lane to carry the north-bound traffic. A new parallel 24-ft. bituminous pavement was built to accommodate the south-bound traffic. The old pavement was widened 6 ft. on one side using 6 to 8 in. of bituminous base placed on the inner or island side. This base was placed in 2-in. layers, the mixture consisting of limestone aggregate with 5.5 percent of RT-10 road tar. The 24-ft. width was then surfaced with two layers, each 1½ in. thick using an open-graded mixture of trap-rock and tar. It was subsequently sealed with tar and sand and six years later given an emulsion-granite chip seal. This pavement resurfacing has performed

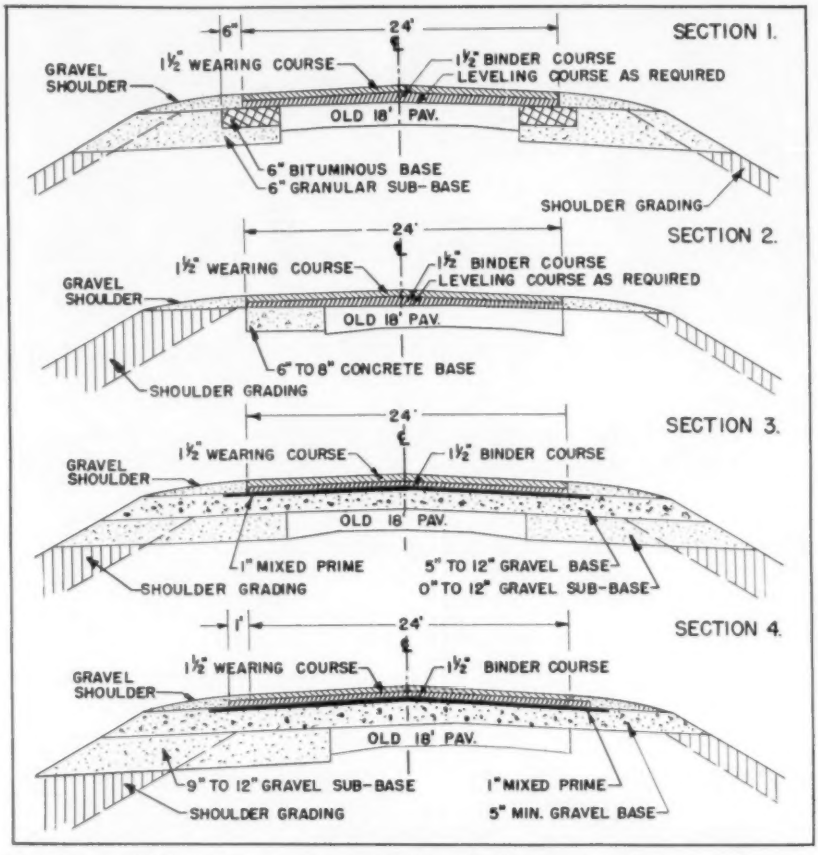
well, with no evident weakness other than a crack at the juncture of the old pavement and the widening and some slight consolidation along the same joint.

In 1944 and 1945 the Maintenance Division initiated two more projects involving the smoothing up of old pavements using tar-gravel road mix methods. In 1946 a resurfacing project was undertaken, by Maintenance Division contract, in which a 1½-in. plant mix mat was placed to smooth the old pavement and widen it to 20 ft. Inasmuch as the latter resurfacing was to be only a temporary expedient, no base was placed under the widening.

Since the war, an extensive program has been carried on by the Construction Division to bring up to modern standards the approximately 600 miles of 18-ft. pavement. This program was begun in 1944 with a 20-mile project on a section of pavement built in 1922 much of it over swampy area now considered totally unfit for pavement support without substantial subgrade correction and base construction. It was in a serious state of deterioration, reflecting in large part the inadequate subgrade conditions, and had become extremely difficult for the maintenance forces to keep in a satisfactory state of repair. The existing pavement was widened with gravel base. On some sections of the project, gravel base was placed over the full width followed by bituminous plant-mixed binder and surface courses. On the remaining portion the bituminous mixture was placed directly on the old slab with no intervening base course. Similar projects were set up on the same highway and others in the same area of the state and from these projects experience was gained that assisted in setting up criteria and design standards for the subsequent rehabilitation of many miles of substandard pavement. At the present time much has been accomplished towards attaining the goal of having all of the 600 miles of 18-ft. pavement widened and resurfaced.

Design of Base Widening

A number of designs have been used for the widening of the existing pavement. The Department has not attempted to set a standard design to be used in all cases. Conditions vary from project to project and each has been considered as an individual case taking into account the condition of the subgrade and the old pavement, physical and topographic features which affect the manner of widening and the availability of materials suitable for the base and the bituminous resurfacing.



● **FIG. 1. FOUR typical sections used for widening rural projects in Minnesota. Variations of these four methods are used according to needs and local conditions.**

In some instances the widening has been placed on one side only, in others on both sides. In most cases it has been a combination of both. On some projects the widening has been done with concrete, on some with gravel and on others with lean bituminous base mixture.

Typical Sections. In Figure 1 are shown four typical sections which have been used on rural projects. Although only four are shown, variations of these make a total of nine which have been used for the rehabilitation of rural highways. The typical sections are described in the following paragraphs.

Section 1. In this section, the old pavement is widened on each side with 6 in. of bituminous base placed on 6 in. of granular subbase. The latter is placed to the full width of the road. Although bituminous base is now the more frequently used, gravel base was more commonly used in the earlier years. Thicknesses ranged from 7½ to 12 ins., dependent upon the subgrade soil; 6 in. to 8 in. concrete base has also been used, placed 3 ft. wide on each side. The bituminous base, as is evident from Section 1, is placed 6 in. wider. In this section the bituminous surfacing is placed directly on the old concrete pavement the latter being in such a condition that the reflection of cracks through the bituminous surfacing is not anticipated as a serious problem. Where the old pavement is rough the use of a leveling course may be required.

Section 2. Where circumstances permit, the widening is done on one side. There are certain advantages to this practice. Better contruction can be effected by building the widened roadbed and subgrade as well as the base course in one wide section as compared with two narrow strips. It is also better for the travelling public as well as for the contractor where traffic has to be carried on the road during construction. Also there is the advantage that there will likely be only one new longitudinal joint developing rather than two. It is also better from the standpoint of distribution of load to the subgrade because of the tendency of traffic to straddle such joints rather than to stay inside as is likely with a joint 3 ft. from the edge.

Shown in this section is the use of

a 6-ft. widening of concrete 6 to 8 in. thick. We have also used 6 in. of bituminous base or granular base placed on 6 in. of granular sub-base as required. Again, for the same reasons as in Section 1 the bituminous surfacing is placed directly on the old concrete pavement.

Section 3. On many of the projects all or portions of the old concrete slab has been in poor condition, being badly cracked and broken, spalled and showing various degrees of disintegration. In such cases, of course, it would be unwise to place the bituminous surfacing directly on the old pavement. The idea was proposed and adopted of placing a 6-in. layer of gravel between the old pavement and the resurfacing. This would serve two functions, that of dissipating any water which came through the old pavements, which condition was sometimes present; and of reducing the reflection of cracking in the new resurfacing from the concrete below. In practically all cases, the layer of granular material has fulfilled its functions very well.

Section 3 illustrates this type of construction in which the old pavement is widened on each side with a specified depth of gravel subbase. A gravel base (5 to 12 in.) is placed over the full width, of which the center 26 feet are mixed-primed to a depth of one inch. After this usually two courses, each 1½ in. thick, are placed to a width of 24 ft.

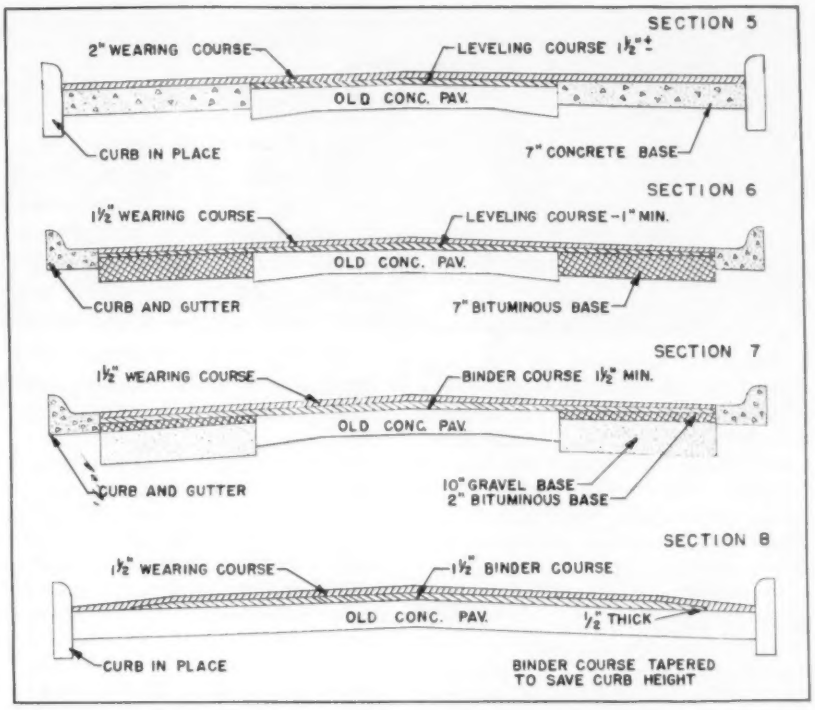
A variation of this design is to place a granular lift, usually from 6 to 12 in. in depth to the full width, shoulder to shoulder, without trenching along sides of the old pavement as shown in Section 3. Although present practice calls for two 1½-in. bituminous courses, some projects have been built with only one course while one was built with three courses totaling 5 in., in addition to the mixed-prime which in that case was 2 in. thick.

Section 4 is similar to Section 3 except the widening is done on one side only. In this as in the case of Section 2 the new center line is 3 ft. from the old center line.

Variations are made from the above typical sections as circumstances require but those described are generally representative of the mileage built up to this time.

Urban Sections

Typical sections used in the rehabilitation of old pavements in urban areas are shown in Figure 2. The designs are self evident and require little further explanation. In most cases the bituminous surfacing is laid in two courses, each usually being 1½ in. thick. Where the old pavement is quite rough a leveling course is used in addition to a binder and wearing course. In some cases, as illustrated in Sections 5 and 6 of Figure 2, a leveling course is used to correct the irregularities in the old pavement, after which a wearing course 1½ to 2 in. thick is placed.



● **FIG. 2. TYPICAL sections used in the rehabilitation of old pavements in urban areas. Bituminous surfacing is usually laid in two courses, each 1½ inches thick.**

Where granular sub-base is used the material is required to conform to the following:

Sieve Size	*Total % Passing*
3-inch	100
No. 4	55-100
No. 10	35-100
No. 40	5-50
No. 200	0-10
Plasticity Index	0-6

The granular material for base course is required to meet the following specification:

Sieve Size	*Total % Passing*
1-inch	100
¾-inch	90-100
⅜-inch	65-95
No. 4	50-80
No. 10	35-65
No. 40	8-35
No. 200	3-10
Maximum Plasticity Index	6

More recently on some heavy traffic roads the gravel gradation has been modified to provide 30 to 55 percent passing the #10 sieve and 10 to 30 percent passing the #40 sieve with a maximum plasticity index of 5.

Placement of both sub-base and base has been required to be in layers with the maximum thickness after compaction limited to 3 inches. Current practice is to require a density of not less than 95 percent of maximum density as determined by standard method AASHO T 89 in the sub-base and 98 percent in the base course. Gravel is obtained from local sources and experience has taught us that the percent passing the #200 sieve must not exceed 10 (5 percent is better) and the Plasticity Index must not exceed 6. Where these limits are exceeded instability of the base course may result.

Compaction of base courses is accomplished generally with pneumatic tired rollers. In narrow trenches, where widening is done on both sides a trench roller is required. Compaction to high density is extremely important in that higher stability is obtained and future consolidation under traffic is minimized.

The bituminous base course, when specified, is required to be constructed in layers not exceeding 2½ in. The mixture is required to conform to Minnesota Highway De-

partment Specification 2331, 2341 or 2351 later described under Bituminous Surfacing. The asphalt content is usually held at approximately 3 percent.

Concrete, when used for widening, is placed from 6 to 8 in. in thickness and conforms to the requirements for base course. Base course concrete is anticipated to have a strength of 3400 psi at 28 days of age.

Bituminous Surfacing

The surfacing used on the type of projects described consists of one of three different types of bituminous hot-plant mixtures in the Minnesota Highway Department specifications. These are known as:

Spec. 2331 Single Aggregate Type
Spec. 2341 Divided Aggregate Type
Spec. 2351 Hot Asphaltic Concrete

The first two types consist usually of gravel aggregate obtained from a local pit although they may be combinations of gravel, sand and crushed rock. In most cases, however, the gravel in the pit is of such gradation that, with proper manipulation, material can be obtained to meet specifications. In the case of 2331, Single Aggregate Type, the gravel consists of the natural run of material in the pit, produced by crushing to maximum size the product obtained by appropriate mixing and blending prior to crushing. The 2341 aggregate is produced in a similar manner but the specification is more restrictive and the aggregate is divided into two sizes and recombined to produce the desired gradation. At times it is necessary to waste "fines" or add rock to obtain material conforming to specifications. The specifications for the aggregate in Specification 2341 further require that at least 30 percent of the particles retained on the No. 4 sieve be crushed. In urban work and on the higher traffic rural roads where 2341 is specified, the addition of mineral filler is required in which case the composite gradation specification is modified. The 2351 specification is typical of the familiarly known asphaltic concrete.

Specifications for the composite gradations of aggregates in the three types of bituminous surfacing are shown in Table 1.

The choice of the type of mixture for any project has been premised on the volume of traffic which the road will carry, with the 2331 mix being used on the lower traffic count roads and the 2351 mix being specified for the high traffic count roads in and near the large urban centers. The penetration of the asphalt cement varies, the thought being to employ the softer grades on the lower traffic roads and the harder grades in the cities; 200-300 penetration asphalts have been used to a considerable extent in the earlier projects although the more commonly used grade on the rural projects has of late been 150-200. In the urban areas 85-100 penetration asphalt has been specified; 120-150 penetration asphalt has been used on many rural resurfacings where the mat is directly on the concrete.

The asphalt content in the 2331 and 2341 types of wearing course has ranged from 4.5 to 5.3 percent of the mixture. Leveling and binder course mixture of both types has averaged about 4.0 percent. Bituminous base is usually placed with about 3 percent asphalt, the maximum being 3.5 percent. The 2351 asphaltic concrete wearing course mixture is placed with from 5.5 to 5.8 percent while binder course mixture is usually mixed at 4.5 percent.

Acknowledgement

Figures 1 and 2 and much of the data for this article have been taken from the paper "Minnesota Practices in Salvaging Old Pavements by Resurfacing" by O. L. Kipp, Assistant Commissioner and Chief Engineer and C. K. Preus, Assistant Engineer of Materials and Research, Minnesota Department of Highways, and presented at the 1951 Annual Meeting of the Highway Research Board.

Data on Costs

There has been wide variation in the costs of the bituminous mixtures and base courses. Except in the case of concrete base course and 2351 asphaltic concrete mixtures, the aggregates for base and bituminous mixtures are made available to the contractor at very nominal cost from state-owned or leased pits. A major variable in costs has been the length of haul.

Average costs of the various items entering into the rehabilitation of the pavements as described above are shown in the following tabulation for the years 1952 to 1954. These figures represent the complete cost in place on the road including aggregates, bituminous material, haul and placing.

Rural Projects

Base Course	1.02 per ton
Concrete Base	3.52 per sq. yd.
Spec. 2331 Single Aggregate Type	
Bituminous Base	3.92 per ton
Leveling	4.09 per ton
Binder	4.00 per ton
Wearing	4.44 per ton
Spec. 2341 Divided Aggregate Type (With Filler in Wearing Course)	
Bituminous Base	3.65 per ton
Leveling	4.45 per ton
Binder	4.53 per ton
Wearing	5.61 per ton
Spec. 2351 Hot Asphalt Concrete	
Bituminous Base	6.58 per ton
Leveling	4.70 per ton
Binder	7.45 per ton
Wearing	8.90 per ton

Table I—Aggregate Requirements for Bituminous Surfacing

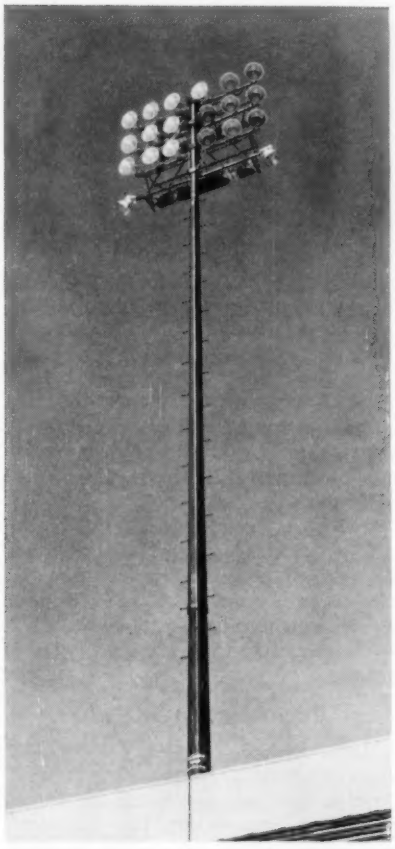
	2331	2341*		2351**	
	Single Aggregate	Divided Aggregate		Hot Asphaltic Concrete	
		Without Filler	With Filler	Wearing Course***	Binder Course
Gradation:					
% Passing ¾" Sieve	100	100	100	100	100
" " ⅝" "	95-100	95-100	95-100	95-100	95-100
" " ⅜" "	65-95	65-90	65-90	70-85	—
" " #4 "	—	50-70	50-70	50-65	40-60
" " #10 "	35-65	35-55	35-55	35-50	25-40
" " #40 "	10-35	10-30	15-30	15-30	—
" " #80 "				8-16	—
" " #200 "	1-7	1-7	4-8	4-8	0-5
Liquid Limit of Fraction Passing #40	Max. 25	Max. 25			
Shale, Iron Oxides & Similar Materials	Max. 5%	Max. 5%	Max. 5%	(None for quarry rock (Max. 3% for gravels	
Los Angeles Rattler	Max. 35	Max. 35	Max. 35	Max. 35	Max. 35

*Fraction retained on #4 sieve shall have at least 30% crushed particles.

**Coarse aggregate (fraction retained on #4 sieve) is generally required to be Class A rock (trap, quartzite or granite) or Class D which consists of 100% crushed gravel.

***At least 50% of fraction passing #200 sieve shall consist of mineral filler.

FLOODLIGHTING FOR AN ATHLETIC FIELD



● ONE OF the eight 120-ft. high standards used to light the stadium.

For the first time in its existence, Dudley Field, Vanderbilt University's Stadium, was floodlighted when work was completed a few nights before the start of the Billy Graham Crusade in Nashville, Tenn. Though it will be used for night football and other sports and for civic and cultural events, the lighting was made possible by the Graham Crusade. The Crusade Committee wished to light the field to permit the evangelist to conduct night-time services, and the lights were substantially paid for by the Graham group. Capacity crowds attended his services.

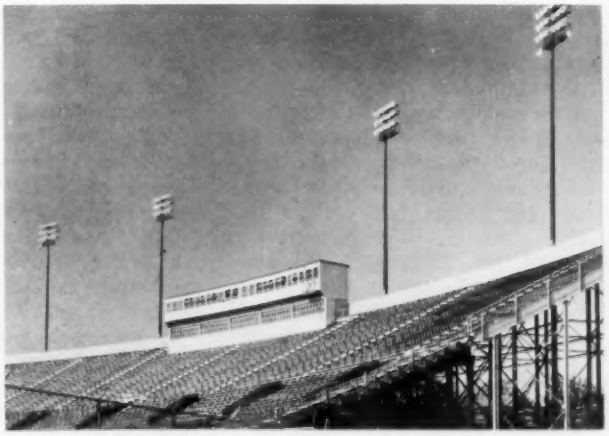
Eight tall shafts carrying batteries of 20,000 lumen flood lights give almost daytime illumination. These standards are the Kerrigan 1400K, octagonal, continuous tapered; some are 120 ft. high. They are made in two sections from corrosion resistant steel; and each is complete with flood mountings and service platforms. Each standard is set on a reinforced concrete base and supported for 100-mile per hour wind loading by a spiral bracket and collar arrangement with ties directly to the stadium. The floodlights are GE type L69.

There are four standards on the west side of the field, located 166 ft. to 181 ft. from the edge of the field when it is marked for football, and placed near the outer rim of the stadium. The distance between them varies from 79 to 145 ft. so as to provide maximum lighting efficiency. There are four standards also on the east side of the field, 106 ft. to 129 ft. from the edge of the field, and also mounted near the outer rim of the stadium; the distance between these standards varies from 95 ft. to 111 ft. The standards on the west side, which is the press box side, carry 22 floodlights each; those on the east side 18 each.

Lighting intensity is about 25 foot-candles at each goal, increasing toward the center of the field so that from the goal lines to the 40-yd. lines lighting intensity is about 30 foot-candles; and between the 40-yd. lines, it is about 35 foot-candles.

Installation was accomplished over a 4-day period, the standards having been made up by Kerrigan on special order over the preceding several weeks. Special equipment was required for installation, including a large derrick to place the poles. Philip Kerrigan, Jr., President of Kerrigan Iron Works, Inc., and Gordon Daniels, director of the Weldforged Lighting Standards Division of Kerrigan, supervised the work which was installed by Edenfield Electric Co.

● STADIUM begins to fill as lights are turned on.



● FOUR of the eight flood lights and the press box.

SEWAGE TREATMENT FOR

Restaurant and service station facilities have been located on the Ohio Turnpike Project Number 1 at intervals of approximately 30 miles. At each location, dual facilities are provided on each side of the Turnpike, with each pair of restaurants and service stations being served by a single sewage treatment plant and by a common water supply. There are eight sewage treatment plants provided for the length of the Turnpike. Each of the sewage treatment plants is identical in basic design.

The location of the sewage treatment plants has necessitated that a very high degree of treatment be provided. In each case, the effluent from the sewage treatment must be discharged to a dry-weather ditch.

Experience at other Turnpike restaurants has indicated that the waste which will be received at the sewage treatment plants will differ significantly from normal domestic sewage. It is expected that the biochemical oxidation demand of the sewage will be approximately double that of normal sewage; although the suspended solids concentration will be significantly less than that of normal sanitary sewage. In addition, a high grease and detergent content is expected and it is also estimated that the raw sewage temperature will average substantially higher than domestic sewage, ranging upward to 130°F.

● ARTIST'S drawing of an Ohio Turnpike Service Area. There are sixteen such buildings, located in pairs, and served by modern facilities for sewage treatment.

Quantity of Sewage

A wide range of sewage flows is also anticipated, varying from periods of virtually no flow in the night hours during the winter periods to 350% of the average flow during the peak load periods in the summer.

After weighing all of the particular design considerations, it was determined that the sewage treatment plants should be of the trickling filter type. Primarily, this decision was made because it was believed that trickling filters were more amenable to the high grease and detergent concentrations; could more easily handle the wide range in flows; and in addition could be operated with less attention than other types of treatment.

Because there was no reliable basis for estimating the quantity of sewage flow at each of the eight installations, the flow to each sewage treatment plant was rather arbitrarily determined on the basis of the number of table seats and counter seats at each restaurant. The basis selected was 150 gallons per day per table seat and 350 gallons per day per counter seat. This basis was used because studies on the Pennsylvania Turnpike indicated that it was reasonably accurate. Since each of the eight pairs of restaurants are identical in size, the flow at each of the sewage treatment plants was thus estimated to be the same, and was computed at an average of 100 gallons per minute, including a reasonable factor of safety.

The sewage treatment plants consist of the following units:

1. A Control Building, which is basically a sewage pumping station, containing a raw sewage wet well and two recirculation wet wells; a comminutor for the raw sewage; and chlorination facilities. Chlorine will be added either to the raw sewage or to the effluent or to both, as required.
2. Two Clarigesters, each 18-ft. in diameter, which will be operated in parallel.
3. Two trickling filters, each 48 ft. in diameter, which will be operated in series.
4. A hopper-bottom final sedimentation tank.
5. A chlorine contact tank.
6. A final pumping station, which in some locations will pump the effluent to the receiving stream and in others will pump the sewage into the final tank, as local considerations require.
7. Open-type sludge drying beds.

The trickling filters will be operated as high-rate filters, although the secondary filter has been designed as a standard rate filter. The operation of the filters is somewhat unique.

Recirculation Methods

Raw sewage will be pumped to the Clarigesters, from which it will flow to the primary trickling filter and then return to the primary recirculation wet well in the Control Building. A continuously-operating 100 gpm pump (equal in capacity to the average raw sewage flow) will operate from this wet well, discharging to the Clarigesters. The portion of the return flow from the primary filter, which cannot be handled by the 100 gpm pump will discharge into the secondary recirculation wet well which is adjacent to the primary recirculation wet well. Pumps operating from this wet well discharge to the secondary filter. A portion of the effluent from the secondary filter returns to the secondary recirculation wet well, with an amount equal to the raw sewage flow overflowing to the final sedimentation tank.

Under average flow conditions, recirculation equal to the raw sewage flow will discharge to the filters

OHIO TURNPIKE FACILITIES

and to the Clarigesters. During low flow conditions, the primary recirculation will be used to prevent septic conditions in the Clarigesters. This is particularly useful because of another modification of conventional design which has been incorporated into the sewage treatment plant. This feature is pre-digestion of the raw sewage, which permits the injection of the raw sewage into the sludge compartment of the Clarigesters, the sewage flowing upward into the sewage compartment. This procedure has been used at Pennsylvania Turnpike installations with much success in achieving removal of grease. Septic conditions have resulted in the upper compartments of the Pennsylvania installations which the recirculation in the Ohio plants is expected to prevent. Chlorination can be used as a further preventive of septic conditions. Operation in this manner has resulted in very little sludge withdrawal from the Clarigesters, a factor which is not unexpected because of the normally low suspended solids concentration of the raw sewage.

The Clarigesters will be covered by flat wooden roofs and concrete domes will be constructed over the trickling filters. The dome will include glass-block skylights and a ventilator.

The Service Stations

Bids for the 16 service buildings were received by the Ohio Turnpike Commission last December.

The architectural design of these buildings is early Ohio. The walls of the one-story structures will be of buff-colored brick. The slate roof will be supported by a steel frame.

When the buildings are completed in time for the opening of the remainder of the Ohio Turnpike on October 1, 1955, turnpike patrons will enter the buildings through a lobby on the turnpike side of the buildings. To the right will be a dining room seating 150 persons at tables. Directly ahead will be counter seats accommodating 50 persons. A special counter section seating 22 persons is provided for truck drivers, who also will be provided special wash room facilities but who will be free to use the general dining and rest room facilities if they should prefer to do so.

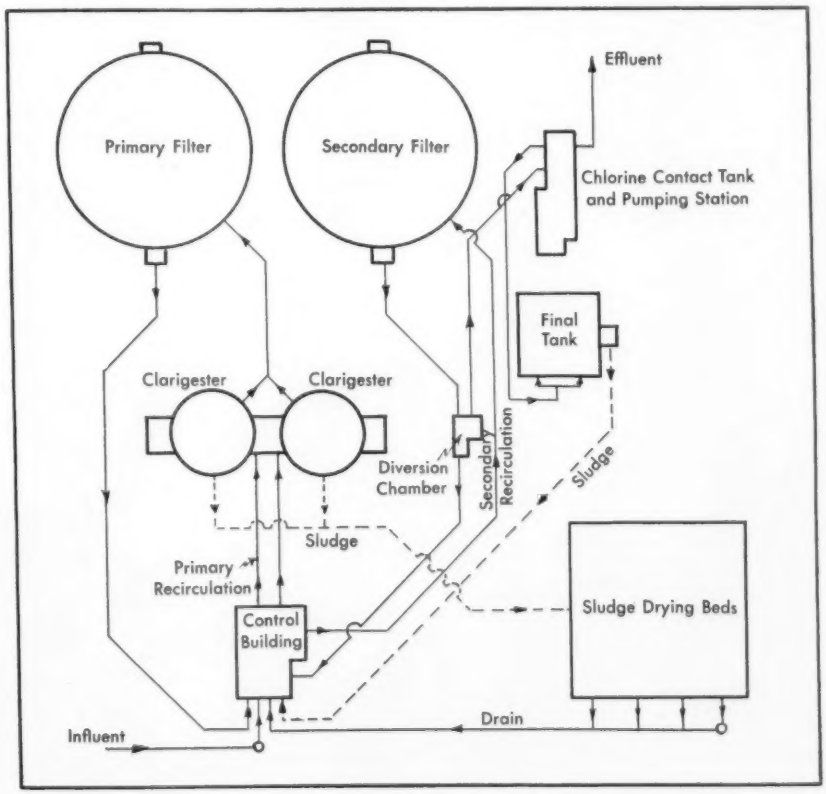
A carry-out snack bar will be located on the right side of the service building to permit fast service for travelers who want only packaged foods such as sandwiches, pies and ice cream and coffee or soft drinks. A garden and playground approximately 50 feet square will adjoin the service building and will allow outdoor dining in good weather. A picnic area about the size of a football field will be located on each service plaza.

Public rest rooms will be to the left of the lobby in the service buildings. The lobby will include a gift counter and there will be a lounge where travelers can relax.

The gasoline service station sales room will be to the left of the lobby. Behind the sales room will be bays for washing or lubricating automobiles.

The service buildings will be 183 feet, four inches in length across the front and will have a maximum depth of 111 feet. A partial basement will include space for boilers, air conditioning equipment and employees' recreation room.

The sewage treatment plant data were furnished us by H. W. Hauenstein of Finkbeiner, Pettis & Strout, Toledo, O., who were the consulting engineers. Descriptive data on the service buildings came from The Ohio Turnpike Commission.



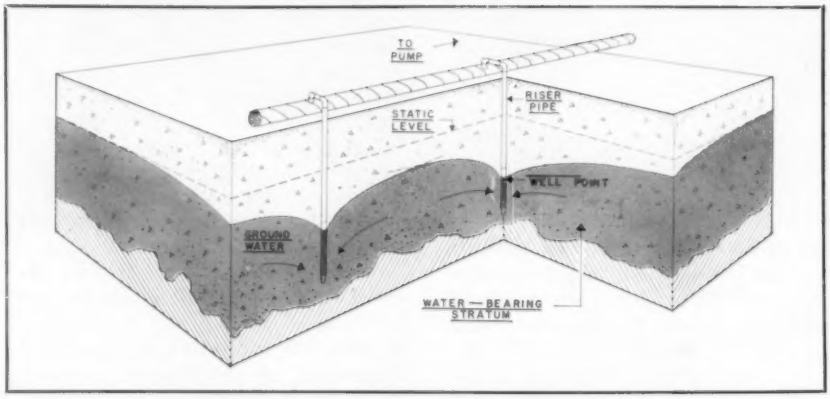
● **PLANT layout and flow sheet of sewage treatment plants for the Ohio Turnpike.**

How WELL-POINT SYSTEMS Do the JOB of DEWATERING

G. F. BRIGGS,

Editor, Johnson National Drillers Journal

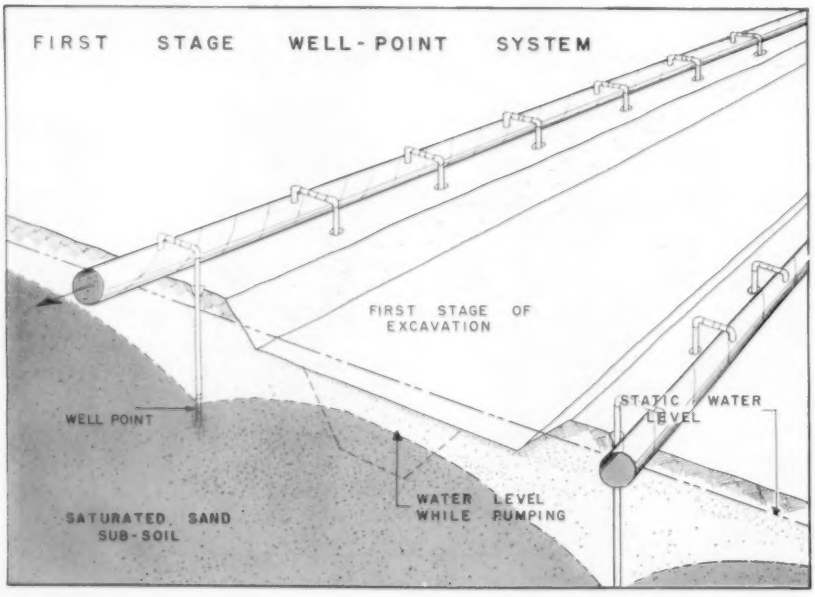
Edward E. Johnson, Inc.



● **WATER table is pulled down by pumping from closely spaced wells, placed on two, three or all sides of the work site, permitting excavation "in the dry." Fig. 1.**

WELL-POINTS can be used to dewater temporarily construction sites in wet ground. Trenches for sewers and water mains and excavations for foundations often have to be carried down into saturated soil below the normal water table. Pulling the water table down by pumping a well-point system installed adjacent to the area to be excavated, permits working "in the dry." In most cases, it is more economical to dewater with well-points than to surround the excavation with a continuous wall of sheet piling and pump from within the work area. Proper dewatering also eliminates the hazards of "sand boils" developing in the bottom of the excavation.

The lowering of the ground-water level over the desired area of a construction site involves creating a composite cone of depression by pumping from the well-point system. To create a composite cone of depression, the individual cones of depression around each well must overlap. This means putting the wells close enough together so that they "interfere" with each other and thus pull the water table down several feet at intermediate points between pairs of wells. This is in direct contrast to the wide spacing of the wells in a system designed for water supply.



● **FIRST-stage system, where more than one stage will be required, is installed as shown here. After the area has been drained, second stage points are installed. Fig. 2.**

Well-points in a dewatering system are usually spaced from two to five feet apart, depending upon the permeability of the saturated sand, the depth to which the water table must be lowered and the depth to which the well-points can be installed in the water-bearing sand.

Figure 1 shows how the overlapping of the areas of influence around two small wells results in a composite depression of the water table. The water level will be kept down to the levels indicated as long as pumping is continued. Water is drained by gravity from the soil above the depressed water table and this soil can then be excavated as dry material anywhere within the composite cone of depression

which is defined by the water levels shown in the illustration.

It should be pointed out that the formation of the composite cone of depression and the resulting draining or dewatering of the sand within this zone do not occur instantly upon starting to pump. Several hours of pumping are required to develop fully the drawdown in the saturated soil around each well-point. Additional time is required for vertical drainage of the water of saturation from the dewatered zone. In practice, this time element makes it necessary to start pumping from the well-point system a day or more before starting to excavate.

On large jobs, detailed pumping tests should be made to determine the best spacing of the well-points and the time required for draining the soil to the desired depth. Proper application of the non-equilibrium theory in analyzing the pumping test will give the answers to both these questions.

The maximum drawdown that can be maintained in the formation adjacent to each well is the vacuum or suction head in feet developed by the pumping equipment minus the distance from the center of the pump to the static water level and minus the head losses in the piping and the well-points themselves. The limitations are imposed by the suction head that can be developed by the pump. Considerable advantage can be gained if it is possible to excavate initially almost to the static water level and then set the pumps at this lower elevation.

Factors Affecting Drawdown

In any case, pumps that are specially designed for dewatering work cannot be depended upon to pull the water down in the formation adjacent to each well-point to a level more than 20 to 22 feet below the center of the pump. This means that on an average job where the sand is fairly permeable a single-stage well-point system can dewater only sufficiently to permit excavation in the dry to a maximum depth of about 16 feet below the pumps. This may mean lowering the ground-water level anywhere from one or two feet up to 15 feet, depending on the height above static water level at which the pumps are set.

The suction head of the pump thus imposes a definite limitation on the depth to which the soil can be dewatered by a single group of well-points. This limitation can be overcome, however, by using two or more separate systems installed in successive stages. Figures 2 and 3 illustrate this principle.

The first stage system is installed as in Figure 2. Pumping lowers the water table enough to permit excavation several feet below the original ground-water level. The second stage system is then installed at the lower level as illustrated in Figure 3. The well-points, header pipe and pumps of the second stage are all set as far below the first stage as the conditions permit. Pumping this system then pulls the water level down sufficiently further so the excavation can be completed to the desired depth. A third stage may be added if even deeper dewatering is needed.

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Continued pumping of the second stage system may drain the soil around the first well-points leaving them dry. Operation of the first stage is stopped if this happens. Pumps and other parts of the first stage can then be used on the second or third stage systems, but they will probably have to be re-installed when the time comes to remove the lower stages.

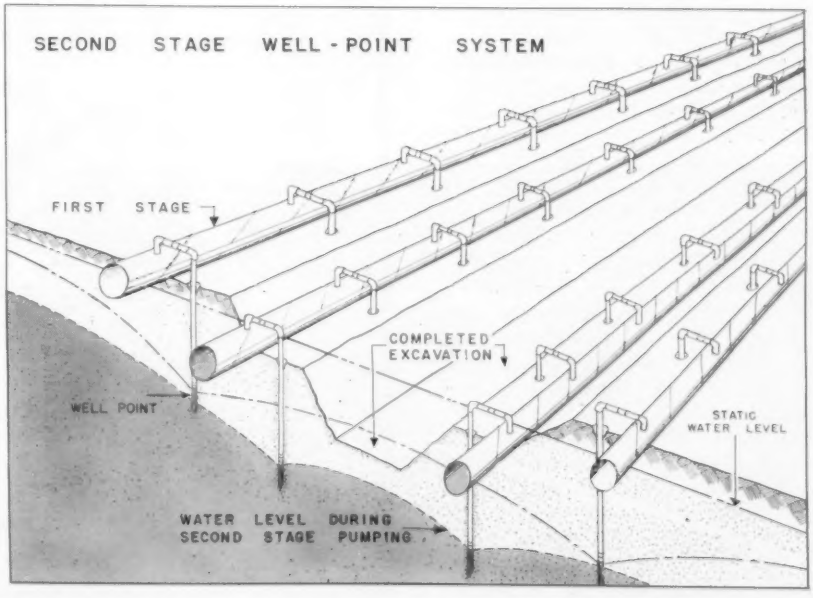
Under favorable conditions, the water level can be pulled down in steps of about 15 feet by "stage dewatering." Steps of 10 to 12 feet per stage are more usual, however, and represent average conditions.

Two separate well-point systems may also be required where two strata of saturated sand separated by an impervious layer of clay are encountered. In such a case, one set of well-points may be sunk to the top of the clay in the upper sand and the other set carried down to the desired depth below the impervious layer in the lower sand.

Efficiency Important

The discussion of the maximum drawdown that can be produced by suction lift points up the importance of designing the system for good hydraulic efficiency. Every foot of head loss in the system means a reduction of one foot in the depth to which the area will be dewatered by the system.

First of all the well-point screen itself must be sufficient. Experience has proven that the continuous-slot type of well screen, with V openings that widen inwardly, is the best on several counts. The large inlet area of this screen results in low velocity through the openings and, consequently, minimum friction loss in the screen. The V shape of the screen slot openings prevents clogging that might otherwise build up extra resistance to flow. The V-shaped openings also permit removal of the finest particles of the formation leaving the coarser particles as an envelope around



● **SECOND-stage well-point installation is made at lower elevation after excavating to the depth permitted by the drawdown from the first stage system. Fig. 3.**

● **HIGH water table encountered in the construction of the Erie, Pa., sewage treatment plant, was lowered by using well points, Jaeger pumps and GM diesel engines.**

the well-point as a natural gravel pack. This local development of the formation around the well-point takes place when each well is being pumped out to clean it immediately after sinking it to the desired depth. Continuous-slot well-points can be obtained in wide range of sizes of openings which permits using the right screen to fit the grading of the water-bearing sand that is to be dewatered.

Second, sizes of pipe and fittings must be large enough to keep velocities reasonably low throughout the system. In some cases, a larger size of header pipe might be used in a portion of the system near the pumps where the volume of flow is greatest.

The third important step to take in making the system efficient is to do everything practicable to keep air out of the system when operating. Joints in the riser pipes, connections to the header pipe and joints and fittings of the header pipe must all be air-tight. A valve in each connection from riser to header pipe to control the flow from each well-point is most important. Every well-point will not operate the same because of variations in the character of the water-bearing soil from place to place over the area. Also, the effective suction head on the well-points nearest the pumps is greater than on the more distant ones. One or more well-points may become unwatered and break suction for one of these reasons and allow air to enter the system. A valve in each connection permits the troublesome wells to be throttled and the air leak to be stopped. The valve may also be completely closed so that an individual well can be repaired or cleaned without shutting down the whole system.

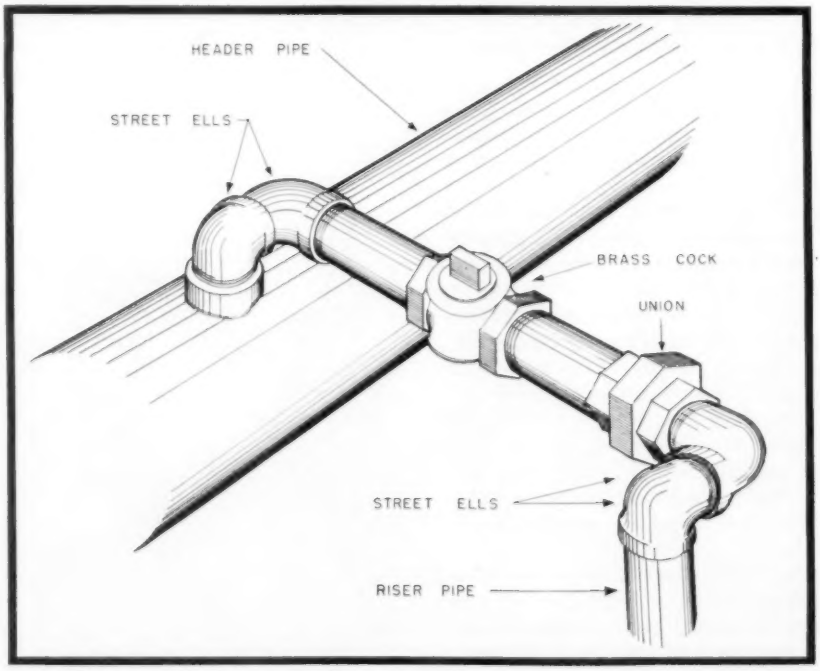
Depth of Setting

The proper depth to which the well-points should be installed is influenced by three factors: (1) the maximum depth of the proposed excavation, (2) whether or not a bed of clay or rock will be encountered at this depth and (3) the existence and depth to any intermediate layers or seams of impervious material in the sand.

Assuming the water-bearing sand continues several feet below the bottom of the excavation, the well-points should be sunk deep enough so that their tops are at least three feet below the deepest part of the excavation. If only a single line of well-points is to be used for a trench job, the tops of the well-points should be four feet below the trench bottom. It is preferable to set the well-points at even greater depths with respect to the bottom of the excavation if conditions permit. Deeper settings insure that the entire length of each screen will always be below the lowest pumping level.

If the excavation is to be carried down completely through the saturated sand to an underlying bed

(*Continued on page* 156)



● **DETAILS of flexible connection for fittings from riser pipe to header pipe.**

● TEXAS roadside park, showing table unit which consists of table and benches, firebox and incinerator. Incinerator at left was built from plans on page 86.

Trash Disposal Units for ROADSIDE PARKS

E. M. PRITCHARD,
Ass't. District Engineer
BEN J. LEDNICKY, SR.
Landscape Adviser

THE TEXAS Highway Department started its Roadside Park Program in 1933. There was no literature on the subject of Roadside Development and Roadside Parks so consequently most of our knowledge had to come by the trial and error method.

The Park Program laid dormant during World War II, but was reactivated in 1946 and has been greatly expanded. There are approximately 700 roadside parks in Texas, ranging from single table units to large multiple units. All parks are of a permanent nature, built either on the existing right-of-ways or on sites specifically acquired for park purposes. All fixtures and furniture are of permanent construction — of concrete, masonry, brick or other material selected locally.

Many improvements have been made in the fireboxes, tables, arbors, headwalls, etc., but the disposition of the refuse has remained a problem and, with the increased use of the parks, has become a sanitation headache. It can be seen in the photos that disposal of trash is an unpleasant chore even under the best of conditions. Viewing these conditions the thought occurred: Why is it necessary to load the garbage into a truck and cart it away? Why not bury it?

Much thought was devoted to the solution of the problem of disposing of trash and refuse and we have evolved the disposal unit that is the subject of this article. This unit is a combination incinerator and disposal well. Combustible material is burned in the incinerator and the ashes, garbage and other refuse falls through a grate into the disposal well. This eliminates the rehandling of park refuse. Whenever the disposal well fills a new hole can be drilled in the immediate vicinity and the incinerator unit moved over.

Our first experiment was very simple. With a core drilling machine we drilled a hole at a table in one of our roadside parks. Then we chiseled a hole into the bottom of an existing masonry incinerator (see page 86) and moved it over the hole in the ground. The results were very gratifying. One suggestion led to another until twenty corrections and twelve months later we finally evolved the installation that is herein illustrated. The unit is so designed that it can be constructed either at the park site in place or on an assembly line basis in the maintenance yard. It has been found that old grader blades are too brittle and are not satisfactory for moving these units; metal bars have been substituted.

These units can be located near the tables for they do not give off any objectionable odor. A core drilling machine is used to drill a hole at the desired location. We prefer to use a bit 30 inches in diameter as that is about the maximum size for a small machine. A hole 24 ins. in diameter and 15 feet deep has a volume of 1.72 cu. yd. while a 30-inch hole of the same depth has a volume of 2.72 cu. yd.

Some soils may present a problem of caving so a section of corrugated metal pipe approximately 3 feet long is inserted into the throat of the hole. It will be noted that this corrugated pipe is not fastened to the concrete base, so that the unit can be moved to a new hole when the existing one fills. In case the incinerator units are built at a central point one can be delivered and set over the disposal well. These

● INCINERATOR completed, front view. Papers can be left burning without hazard.

● **COMMON scene in many roadside parks, Texas and elsewhere. Incinerator described here has helped a great deal.**

● **CLEANING an incinerator is an unpleasant chore. Garbage shown in photo was several days old and attracted many flies.**

units should weigh approximately 3500 pounds and can be handled by an A-Frame or by skidding onto trucks. If the units are to be built at the location, the building operation is the same. A piece of plywood can be placed over the well when pouring the base and later sawed out for the grate opening.

Construction of the incinerator is very simple. We find old paving bricks excellent but any type of masonry is satisfactory. Experience indicates that it is not necessary to line the inside with fire brick. The cleanout door was eliminated for two reasons. (1) Because it is not necessary; and (2) to reduce the amount of draft causing burning embers to be scattered over the countryside. The screen on top serves several purposes, chiefly to prevent burning firebrands from causing a fire hazard. Sunlight and air are admitted. A woven wire screen of one-half inch mesh or less is satisfactory.

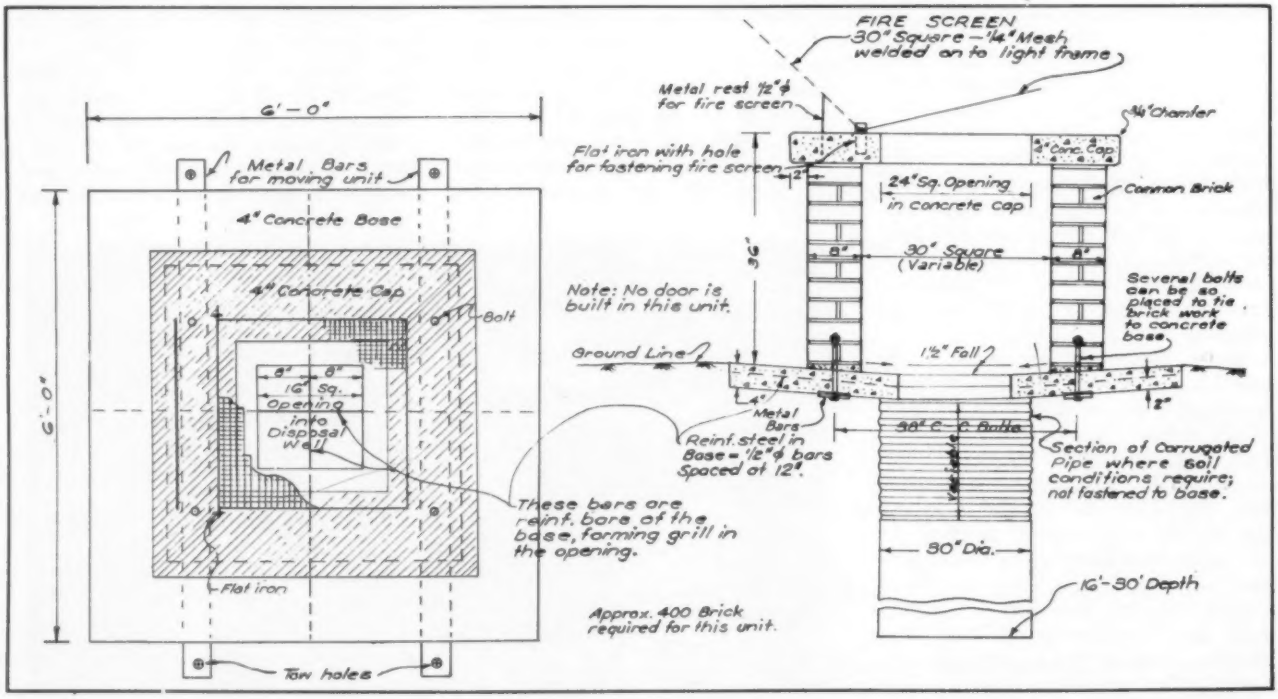
Our first thought was that these disposal wells would fill readily and we would be busy drilling new holes. However, we were happily disappointed in this thinking. In one of our roadside parks, having as much traffic as any roadside park in the State, we installed three of these trash disposal units on an experimental basis, each with a disposal well 30 inches in diameter and 15 feet deep. The park was in use during the 8 months, March through November, and survived one of our famous watermelon seasons. In November by actual measurement we found that the disposal wells filled up only three feet. This appears unbelievable to us but we pass the park every day and note its operation. Could it be that a lot of customers conspired against us and took their garbage home?

The maintenance crews appreciate these combination incinerator-disposal wells at their roadside parks. They can dispose of all the refuse by placing it into a conveniently located unit instead of having to man-handle the heavily laden cans into trucks.

● ● ●

Letting Hair Down Clogs Sewers

Too many people let their hair down on New Year's Eve in Thornton, Ill. Supt. Don Maxwell spent the last day of 1954 cleaning a blocked sewer that caused basement flooding at two homes. The block was caused by sand, rags, and mostly hair from two beauty parlors.


FIRE SCREEN
30" Square — 1/4" Mesh welded on to light frame
Metal rest 1/2" ϕ for fire screen
Flat iron with hole for fastening fire screen
3/4" Chamfer
Conc. Cap
24" Sq. Opening in concrete cap
Common Brick
30" Square (Variable)
Several bolts can be so placed to tie brick work to concrete base.
Note: No door is built in this unit.
Ground Line
1 1/2" Fall
Metal Bars
Reinf. steel in Base = 1/2" ϕ bars Spaced at 12".
Section of Corrugated Pipe where soil conditions require; not fastened to base.
These bars are reinf. bars of the base, forming grill in the opening.
30" Dia.
16'-30' Depth
Approx. 400 Brick required for this unit.
6'-0"
Metal Bars for moving unit
4" Concrete Base
4" Concrete Cap
Bolt
8" 8" 16" Sq. Opening into Disposal Well
Flat iron
Tow holes

● **PLAN view and side elevation of standard combination incinerator and disposal well designed by the Texas Highway Dept.**

METERING WILL SAVE WATER AND PROVIDE PLANNING DATA

CHARLES F. KILLELEA, Acting City Manager, Rome, N. Y.

WITH current plans to meter all commercial and industrial water users in the city, Rome, N.Y. has taken the first step to bring its record 292 gallons per capita demand for water closer to the national average of 140 gallons. Rome is fortunate in having a supply of soft water delivered by gravity. But it is unfortunate in having one of the highest per capita consumption rates for cities in New York State with a population of 10,000 or more.

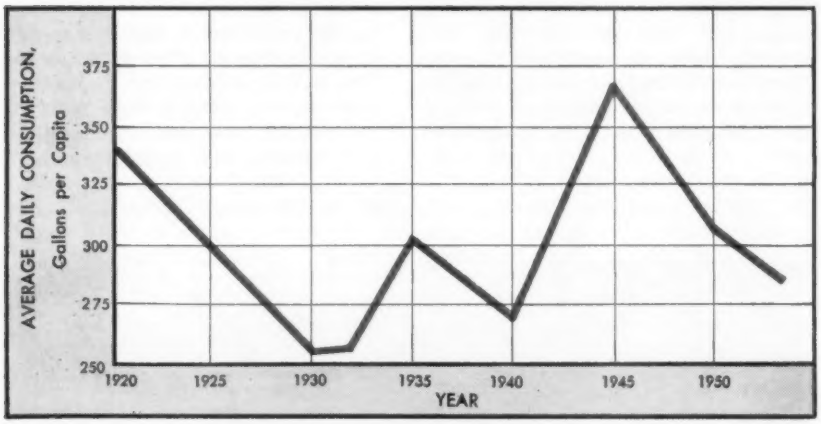
The amount of Rome's daily consumption over the national average is a matter of grave concern. Back in 1897 Rome faced a similar situation in meeting the needs of a growing community. There is a prophetic paragraph in an engineering report written in that year which applies to today's problem. The report prepared by the Stanwix Engineering Co., said:

"It may be said within reason that the consumption of water in the city is great, and by the introduction of meters and a system of rigid inspection it can be materially reduced."

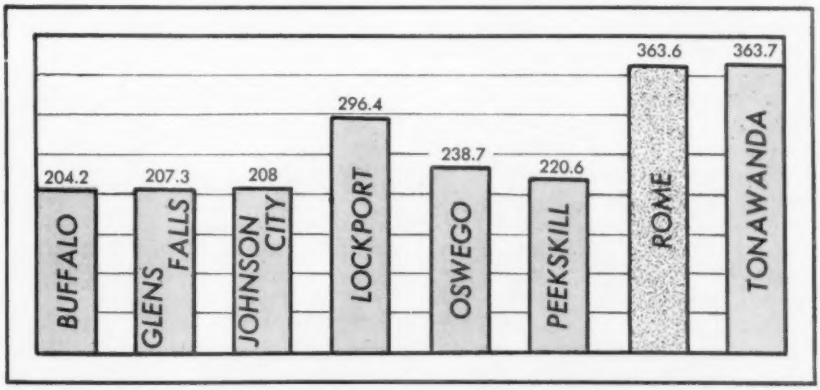
Now, providing for the increasing needs of a growing industrial city, we are faced with the urgent need for building a large impounding reservoir to conserve our water at its source. Some method of preventing waste of our water supply after delivery to the consumer must be devised or again in 1990, and possibly before, more money must be spent for more sources.

A study of Rome's water system was made in 1948 by students in the Department of City and Regional Planning of Cornell University. This report called attention to Rome's extremely high per capita consumption. The report recommended complete water metering for all consumers at the earliest possible date and a thorough leak survey. Another study was made by a subcommittee of the Municipal Affairs Committee of the Rome Chamber of Commerce. It covered a period from March, 1951, to March, 1952, and made two points. One was that metering of all consumers might save approximately 3.3 million gallons daily; and secondly, that Rome's water rates were moderate but showed a reversal of normal trends in that industrial-commercial rates were in excess of residential rates.

A survey by the Syracuse engineering firm of O'Brien & Gere this year recommended "that the city of Rome should inaugurate a program of installing meters in domestic consumer service connections as soon as possible. It has been universal experience that the installation of meters leads to a reduction in per capita consumption



● **PER CAPITA water consumption in Rome, New York, from 1920 through 1953**



● **PER CAPITA water consumption in 1945 of eight New York State cities.**

of water. This reduction is normally occasioned by instituting a practice of repairing leaking fixtures and by cessation of wasteful practice in the use of water."

In addition to the recommendation for metering, O'Brien & Gere recommended the construction of a storage reservoir on the East Branch of Fish Creek about 8.5 miles above the present diversion dam.

From the inception of a city water system in Rome somewhere back in 1867 until the present day there has not been one year of firm statistics and consumption data upon which an engineer could base realistic planning. To plan intelligently for the expansion of a utility, you must have accurate consumption data. The more accurate your data, the better your planning and the greater value you get from the funds expended. The results of any engineering planning are only as good as the accuracy of the data on which the planning is based. Assumptions are guesses and guesses have no place in a matter as vital as the supply of water.

Back in 1897 the Stanwix Engineering Company stated that the introduction of meters would materially reduce the admittedly high consumption of water. The carefully designed gravity system built in 1910 missed its forecast of sufficient water for 100 years by 56 years. Industrialization and rapid growth accounts for some of the error, but had the city known, quarter by quarter, what its consumption requirements were; had the city been able to correct leaks in the system, insist on conservation measures in industry, and really control a commodity which in 1953 cost $64.50 per million gallons to produce, deliver and dispose of, we could still be using water within the supply possibilities of the present system.

The available facts on our water supply show that there are some meters in use. Of 609 industrial and commercial users, 109 of the largest users of water are metered. In 1953 some 4172 million gallons of water were delivered to consumers in Rome. Of this amount we can factually account for the 1872 million gallons used by the 18 percent of industrial-commercial users who are metered. In addition, there are the institutional users, the fire department, over 8000 residential consumers, and leakage losses. The problem is to separate them. We have no definite figures on the quantity of water lost through leakage, consumed by the 496 unmetered industrial-commercial users, by domestic users, and by the other users of water. Some 2300 million gallons or 57 percent of the water produced during 1953 was not accounted for.

It seems incredible that a small stream of water will waste 250 gallons in 24 hours and cost the city $5.89 a year. Probably a 10-cent washer and half an hour's time would fix it—but why bother if it costs you nothing to let it run. If you knew that you would have to pay for water wasted like this, you would fix your leaks quickly. There is no way of knowing how much of the 2,300 million gallons we cannot account for were wasted in this manner in 1953.

Visits to industrial users disclosed much wasteful consumption of water. There are also many instances of inequality; for example, a consumer using water for air conditioning paid on a metered rate $397.20 for his 1953 water bills. Another user also using water for operating an air conditioning plant of similar capacity paid at an unmetered rate of $17.00 a year. There are many similar instances. These unpredictable variations, the many leaks and wasteful practices observed make it impossible to say what benefits would be realized by the installation of meters. The certain tangible benefits to be derived are a factual knowledge of how water is being used; construction of a sound and equitable base for payment of the water; and the establishment of consumption data from which practical control of leakage can be planned. These appear to be mighty important considerations.

The Rome Chamber of Commerce report points out that metering of domestic consumers might save 3.3 million gallons per day. This amounts to 1,204.5 million gallons yearly. Translated into value, it represents, based on the O'Brien-Gere estimate of construction cost of $1,110 per millon gallons of capacity, the amount of water which could be stored by a reservoir costing $1.34 million.

Metered control means a reduction in consumption and in Rome's particular predicament, it buys time by reducing consumption. The new storage reservoir is a must whether we meter 100 percent or not but before it is built it might be well to examine the water division earnings under its present method of operation, and in the light of the cost of the new storage reservoir.

Water is free but it costs real money to deliver it where you want it and in the quantity you demand. One year's accumulation of data on consumption and leakage compiled by reading meters might change the entire planning picture.

Water Works Emergency Repair Truck

THIS photograph of an emergency repair truck was sent us by Charles W. Horsfall, Superintendent, Board of Water Commissioners, Ossining, N. Y. He gives the following information: It is a 1952 Ford truck with McCabe-Powers body carrying a 125-cfm Jaeger compressor with power take-off from the truck motor. Handy equipment in the truck includes 2-way radio; red flasher lights; siren; barricades; 1-ton hoist; 2-in. ditch pump; generator and lights; foul-weather gear; complete set of tools for distribution system maintenance and repair; service tapping machine and materials; complete set of air tools—hammer, drill, spade and tamper; a complete set of hand tools; and a pipe vise—all useful water works equipment.

● MULTIPLE waste containers are thoroughly cleaned with steam at regular intervals at Ft. Bliss, (U. S. Army photos)

Multiple CONTAINERS Handle REFUSE WITH LESS LABOR

H. K. RIPLEY, Civil Engineer, Office of The Post Engineer Fort Bliss, Tex.

ANY method of refuse collection on a major army installation is at best a difficult process. This is because of the variety of refuse generated, the fluctuations in volume resulting from population shifts, troop movements, and the current expansion programs of many army posts. Here at the Department of the Army's Antiaircraft & Guided Missile Center, the use of a new type of operation has proved efficient and economical.

At Fort Bliss, Texas, prior to FY (Fiscal Year) 1951, and the acceleration of station activities arising out of the Korean emergency, such refuse generation as existed was handled by standard packer type trucks, each normally manned by a driver and two laborers, collecting on a bi-weekly basis. With the expansion of the Fort Bliss activities, including a sudden population increase and the reopening of idle facilities including messhalls, commissaries, and barracks, it became necessary to expand the refuse collection and disposal organization. Meeting the situation indicated a need to triple the existing vehicle and personnel compliment. It was at this time that the possibilities of using a multiple container system were explored. Exhaustive studies indicated that such an operation was feasible and would provide the best solution to the immediate problem; and would further prove the time tested theory that making machinery do a job formerly done by hand saves money, time, and effort.

Thus, in September, 1950, Fort Bliss installed its first increment of multiple container equipment, consisting of forty 10-yd. refuse containers. These were placed at specified points of heavy refuse generation, and were serviced by special hoist-haul collection trucks. The initial equipment has been supplemented with additional containers and hoist-trucks during the ensuing years until now about 70 percent of the station is employing this method. Present intentions are to convert the balance of the post, as far as is practical, to this new type of system in 1955.

The effectiveness of the conversion is shown by operation records. During FY 1951, the average monthly volume of refuse handled was 12,144 cubic yards with a manhour outlay of 2,775 or a ratio of 0.228 manhour per cubic yard handled. In 1952, while meeting a post expansion, with an increased monthly volume of 15,056 cubic yards, manhours were reduced to 2118, a reduction to a ratio of 0.140. In 1953, although the average monthly generation showed only a slight increase, the manhour output was reduced to a ratio of 0.126. In 1954, there was a sharp increase in volume with an average of 18,023 cubic

● MESS hall worker places waste material in a multiple container.

● **HOIST haul truck dumping multiple waste container at sanitary fill.**

yards per month during the period. Yet the manhour output was further reduced to 0.111. The additions of multiple container equipment from time to time to overall system brought about these manhour reductions while refuse volume was on the upgrade. Final installation of equipment, currently on order, is expected to drop the manhour requirement to somewhere between 0.08 and 0.09 per cu. yd. collected.

Attempts to establish accurate indicators or yardsticks for control of refuse collection operations produce arguments as to proper units of measurement. Types of refuse generated on army installations—varying from paper cartons, glassware, boxes, and tin cans to edible and non-edible garbage, with certain points of refuse generation producing more of one kind than of another—render measurement by weight unsatisfactory. There may also be arguments as to the accuracy of measurement by volume due to the fact that a full container may or may not be equal to the rated capacity at the time collected. At Fort Bliss the volume method is used as an indicator, with a log of loads delivered to the point of disposal kept daily. A monthly measurement of the sanitary fill is made to compare the results. The comparison figures are sufficiently close to indicate the volume method is sufficiently accurate for our purpose.

The monetary savings which can be effected on an army installation by the use of the multiple container system are considerable. However, it is not the purpose of this article to present a detailed breakdown of the savings made at Fort Bliss in the four-year reporting period. The savings become apparent by the following analysis:

Our 15-yd. collection truck, requiring a three-man team (truck driver and two laborers), has a maximum potential of approximately 3½ loads per day under conditions existing here. About 24 manhours are required to handle about 53 cubic yards of material, a ratio of 0.452 manhour per cubic yard. A multiple container hoist-haul truck requires the services of the driver only, and at Fort Bliss, on a typical service route, in an 8-hour day, the truck normally averages complete handling of eleven containers, with a labor requirement of 0.072 manhour per cubic yard. It is recognized that more mileage is traveled per truck, but in either case the vehicle is required.

Further savings are established by the fact that standard garbage cans do not, on army posts, have a life expectancy of more than five years, whereas ten years is the minimum expectancy for multiple containers.

A typical example of potential savings by the multiple container system can be established by taking operations for the FY 1954. The average monthly volume for the year was 18,023 cubic yards. Assuming the average daily working period during the month to be 23 days, daily collections approximated 783 cubic yards. Based on our experience with trucks, such service would require 15 trucks manned by 45 men. If one hoist-haul unit can average 11 collections per day or 110 cubic yards, collections can be made with a maximum of eight trucks with drivers. Saving 37 employees, at current government pay scales in this territory, amounts to approximately $113,000 per year. Applying this annual savings against the cost of the primary multiple container system installation produces a complete write-off of the investment in about fifteen months. Savings made on garbage can replacements, administrative costs, and indirect costs, such as sick and annual leave benefits to employees, increase the total. Conservatively, it is felt that the system at Fort Bliss is saving the Department of the Army about $150,000 annually.

Briefly, operating techniques are as follows: All points of heavy refuse generation are equipped, or are expected to be equipped, with 10-yd. containers placed at locations accessible to hoist-haul service equipment and functional to the buildings or areas served. In many cases a bank of two or more containers will meet the requirement of an entire area. The rule-of-thumb measurement factor for heavy generation, as compared to light output, is that any given location should generate at least one full 10-yard container of refuse weekly. There are in service at Fort Bliss 216 containers showing an average of two collections per week per location. Daily logs show about 80 collections per day with a 7-unit hoist-haul fleet. Service trucks are assigned to standard route diagrams which are partially guided by the distance to the point of disposal; but, in general, a normal route contains about 30 stops. Trucks traverse routes daily, emptying only containers which are full or near full, leaving the balance for the following day's work. A detergent type steam cleaning unit is centrally located on the station and all multiple containers are steam cleaned both inside and out once a week, or oftener if found necessary.

Regulations for usage at points of generation require that all excessive liquids be drained from refuse before deposit. Wet or moist garbage must be sacked or wrapped. Cartons and boxes are flattened or smashed down before placement. Items having salvage value are stored separately and not handled in this way.

Close liaison is maintained with the post medical authorities and containers on-site are regularly inspected for compliance with the post sanitation code. Units are both drop-bottom type with closed lid and open top. Open top units serve exclusively in industrial locations producing a heavy, non-blowable waste material. All messhalls, post exchanges, quarters areas, trailer parks, barracks and row type housing have containers with tight, fly-proof lids.

Aside from the savings experienced at Fort Bliss, the use of multiple containers has provided a distinct advantage in overall station grounds maintenance processes. The containers provide a trash disposal point in a specific zone. In consequence, military commanders set up grounds maintenance regulations and all waste materials are placed in the containers. A high state of police results and general grounds appearance constantly improves.

The experience gained at Fort Bliss during four years of operating this system has proved that such an operation is practical, feasible, and efficient for refuse collection and disposal service on any army installation. However, there are always some areas on a post, such as individual dwellings occupied by officer and noncommissioned officer personnel that do not adapt themselves to such a service. The distance is too great from such dispersed generation points to central container stations; and at this installation these locations are still handled by trucks. Continuous studies are being made on all parts of the post. The overall plan is ultimately to convert all possible areas to the new system thus effecting the maximum possible savings.

FLUORIDATION

REDUCES DENTAL CARIES IN EVANSTON SCHOOL CHILDREN

EDWIN J. KNUDSEN

BY THE addition of sodium fluoride to its water supply, the installation of a modern chemical feeding system and careful research methods, Evanston, Ill., has reduced dental carries 46.42 percent among its 6-8 year old school children. These impressive figures resulted after fluorine had been added to the water for a 47-58 month period. This period was the half way point of a 15 year study started in 1946. Also included in the study are 12-14 year old children. The records of about 2,500 children are being used. The plant furnishes water to Evanston, with a population of 73,641 and to the rapidly growing Skokie, Ill., with a population of 23,000.

Noting the high dental caries rates among its children using the fluorine-free water of Lake Michigan, city officials of Evanston held meetings in 1944 with health authorities to discuss the problem. The present study is the outcome of these meetings. Cooperating with the town in the study is Dr. Walter G. Zoller of the Memorial Dental Clinic of the University of Chicago.

Equipment for feeding the sodium fluoride into the system is an Omega gravimetric feeder installed on the main floor of the chemical building. The feeder is loaded through a 12-inch pipe from a hopper on the floor above. This hopper permits an inverted barrel with a capacity of 375 lbs. to be placed on the inside. The chemical is discharged into the dissolving chamber at a rate of 16 lbs. per million gals., which rate is recorded on a chart connected to the scale beam. The dissolving chamber is equipped with water jets to keep the solution circulating, and eliminating the possibility of undissolved material reaching the clear wells. The solution travels by gravity to the point of application through a 2-inch rubber hose.

Three factors rule out the possibility of administering toxic dosages of sodium fluoride: 1. Any over or under dosage causes an automatic alarm to sound. 2. The high solubility rate. 3. The solution is applied at a point that requires circulation through several large clear wells before reaching the high-lift pumps.

To maintain chemical controls and conduct research, a research chemist is assigned to the well-equipped laboratory flanking the chemical room. Water samples are taken from the plant twice a day for fluorine determination and other analyses. The Scott modification of the Sanchis method is used for the fluorine analysis.

The use of sodium fluoride has proved very satisfactory from an operations standpoint. The cost of the fluorine treatment came to $1.86 per million gals. or 9¼ cts. per person in 1953. The chemical is bought in 375-lb. barrels.

Raw water for the Evanston system comes by gravity through two intake pipes extending 5600 ft. and 2600 ft. respectively into Lake Michigan. The first pipe is 36 in. in dia. and the second, 30 in. A problem that sometimes occurs in winter is anchor ice formation. A diver is usually sent down to break up these formations. Four low-lift electric pumps carry the water to the treatment plant.

Treatment consists of pre-chlorination up to a maximum amount of 10 lbs. per million gals., which is handled by a Wallace & Tiernan chlorinator. Aluminum sulfate coagulant is then fed at a rate of about 80 lbs. per mg by means of an Omega feeder. From 30 to 50 lbs. per mg of activated carbon is introduced into the water when needed for taste and odor control by another Omega feeder. Clay is added at times to control turbidity. At plant rated capacity, it takes about 30 minutes for the water to pass through the slow mix compartments, and about 2¾ hours to pass through the settling basins.

The filtration system consists of six 4 mgd filters at standard rating of two gal./sq. ft. per minute in the new building; each filter has an area of 1,400 sq. ft. There are 12 filters of 738 sq. ft. each in the old building. Filtering capacity for both plants is 48 mgd. Leopold tile under drain is used in the new plant, overlaid with 13 ins. of graded gravel and 30 ins. of sand. The underground concrete reservoirs have a total storage capacity of 9.3 million gals. A 1½-million gal. elevated tank is located near the Southwest edge of the city, and a 1-million gal. tank near the Northwest edge.

Final traces of chemical odors are controlled by post chlorination with ammonia.

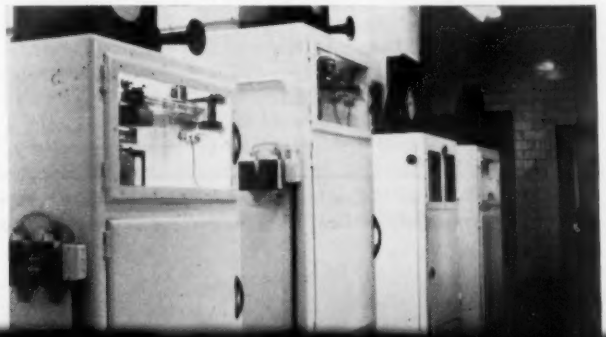
Seven high-lift pumps with capacities ranging from 6 to 15 million gal. per day each, pump water into the distribution system. All electrically driven, they include 5 Worthingtons—a 15-mgd, two 10-mgd, an 8-mgd and a 6-mgd; and one 15-mgd and one 10-mgd Allis-Chalmers pumps.

Doubling of the filter capacity and conversion to all-electric pumping was completed at the Evanston plant in 1951 at a cost of $2,890,000, financed by a bond issue. This amount will be paid for entirely from water receipts.

The engineering firm of Alvord, Burdick & Howson designed and supervised the construction of the plant additions. Horace R. Frye is Supt. of the Water Dept. for Evanston, Ill.

● **LABORATORY** provides for accurate control of dosages.

● **THESE** feeders apply the fluorides to Evanston's water.



SEISMIC EXPLORATIONS Save MONEY

EARL T. APFEL

and LOUIS J. GOODMAN

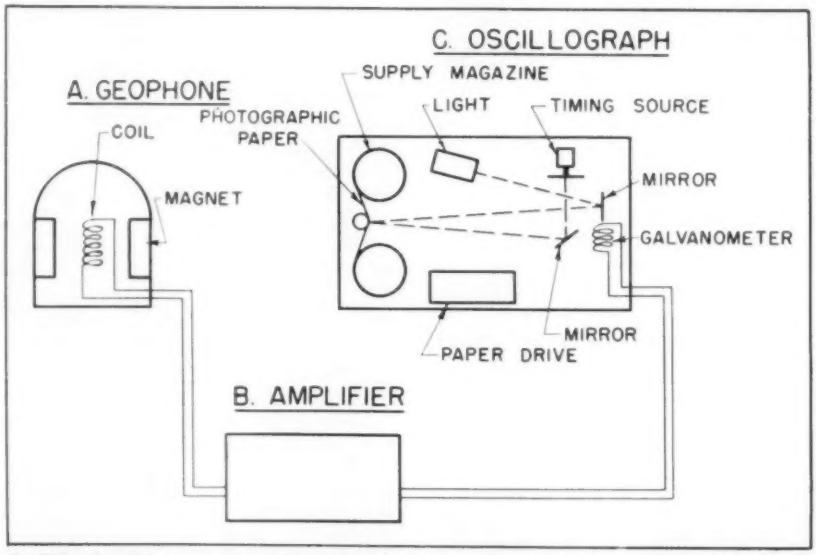
Dr. Apfel is Chairman, Department of Geology, and Director of Geo-Research Division of Syracuse University Research Institute. Prof. Goodman is Associate Professor of Civil Engineering and Soils Engineer for the Geo-Research Division of Syracuse University Research Institute.

A universal question among design engineers and construction men is "what are we building on?" The stability and life of installations from the horizontal spread of highways and airports to the vertical pile of the skyscraper depend upon the proper knowledge and the appropriate use of subsurface materials. Next to the surface of the earth, probably the most important surface of concern to the design man is the surface of the bedrock under the overburden. This article undertakes to tell how information concerning the bedrock surface may be obtained effectively, promptly and accurately by the use of the refraction seismograph.

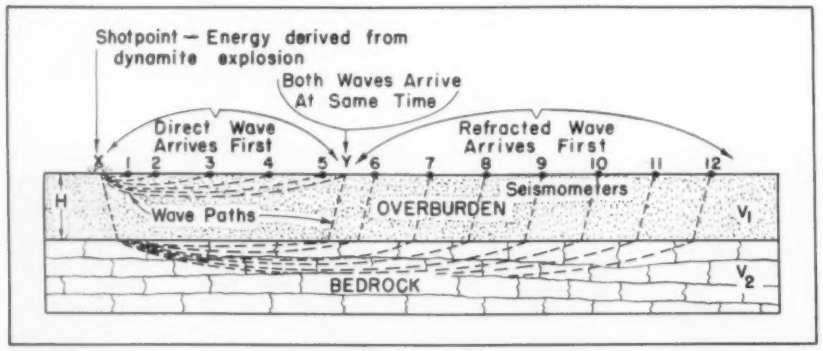
The refraction seismograph is a combination of electrical, electronic and optical equipment which is able to record the time of passage of seismic waves through the earth. Seismic waves are like earthquake waves in that they are vibrations in the ground which travel from a source where they are generated. The generator in the case of seismic exploration is a small charge of explosive—sometimes no more than a single blasting cap and seldom over a pound or two of dynamite. The instruments are set up so that the time of the start of the wave travel is accurately recorded and the time that the waves get to successively distant stations is printed on the record. The records are "read" or interpreted so that the depth to bedrock is known along the seismic line. Some details of the seismic method are explained in the following paragraphs.

Following the explosion, the arrival of a wavefront, both horizontal and refracted, is picked up by the seismometer (also called geophone, detector, or pickup) at point A, Figure 1. This in turn emits an electrical impulse or signal, which is transmitted by means of a cable to the amplifier, at point B. Here the signal is amplified and transmitted to the galvanometer, at point C, were it is recorded.

The galvanometer consists of a mirror attached to a coil and suspended in a permanent magnetic field. A beam of light is focused on the galvanometer and reflected by the mirror onto moving photographic paper. This produces the oscillogram. The timing lines are projected in the same manner from a disk-type light interruptor driven by a synchronous motor. These are focused on a separate mirror and then onto the moving paper; thus the recorded data and the time lines will appear on the paper as black lines on a white background.



● **FIG. 1. Schematic arrangement of equipment setup for making seismic explorations for underground formations as described in accompanying article.**



● **FIG. 2. Assumed subsurface section, with paths of travel of seismic energy from a shotpoint to a line of seismometers previously located in the ground.**

Illustrated in Figure 2 is a typical seismograph set-up or "spread", showing the seismometers placed in progression at predetermined intervals away from the point of explosion, or shot-point. The recording apparatus is usually set up near one end of the spread. In a shallow bored hole at point X a small charge of dynamite is placed and tamped with dirt. When the charge is exploded, the exact instant of the

explosion is recorded on the oscillogram (Figure 3) as "shot time" or "time break."

The energy from the explosion radiates in all directions. Some of the direct and refracted paths of energy, or wave-front, are shown in Figure 2. The direct or horizontal wave reaches the seismometers nearest the shot-point immediately through the low velocity overburden because of the short travel path.

As the wave-front progresses downward, it reaches bedrock which is much more dense in its composition and has a much higher velocity of transmission than the overburden. This change in media causes some of the energy to be refracted along and through the bedrock. The travel time is greatly accelerated because of the higher velocity. Consequently, the refracted wave will soon overtake and pass the horizontal wave. As noted in Figure 2, this occurs between Stations 5 and 6, at point Y. Until this time, all that has been recorded is the travel time of the wave through the overburden. Now that the refracted wave has overtaken and passed the horizontal wave, Stations 5 through 12 will first record only the refracted wave from the bedrock.

An actual oscillogram, or record, is represented by Figure 3. The heavily accentuated wavy horizontal lines are the galvanometer traces. The vertical lines are for timing, and each division is 0.01 second. When the wave-front arrives at the various stations, it is recorded instantaneously and shown as a break in the continuity of the galvanometer trace. The traces still continue, but they are of such amplitude that they cannot be seen on the record for approximately 0.5 second. This amplitude is the result of the arrival of secondary waves. The first arrival information is all that is necessary for the computation of bedrock depth.

The record is developed within a few seconds after the recording and is available for immediate study. The "first arrivals" are measured in time from the "time break". These times are then plotted on graph paper to form a Time-Distance curve, as illustrated in Figure 3; with this curve the velocities can be determined accurately by d/t with "d" as the distance, and "t" as the time.

The exact point where the refracted wave overtakes the horizontal wave may also be measured easily. This is commonly referred to as the "point of intersection," and is measured in feet of distance from the shot point.

When these factors are known, the thickness of the overburden or depth to bedrock may be determined by the formula:

$$H = \frac{d}{2}\sqrt{\frac{v_2 - v_1}{v_2 + v_1}}$$

"H" is the depth to bedrock in feet; "d" is distance to point of intersection in feet; "v_2" is the velocity through the bedrock in feet per second; and "v_1" is the velocity through the overburden in feet per second.

Different kinds of overburden, such as gravel, clay and hardpan or glacial till have characteristic velocities. Accordingly, they may be identified from the travel-time graphs. The characteristics of the bedrock similarly may be interpreted from the seismic data. Some common seismic velocities are shown in Table 1.

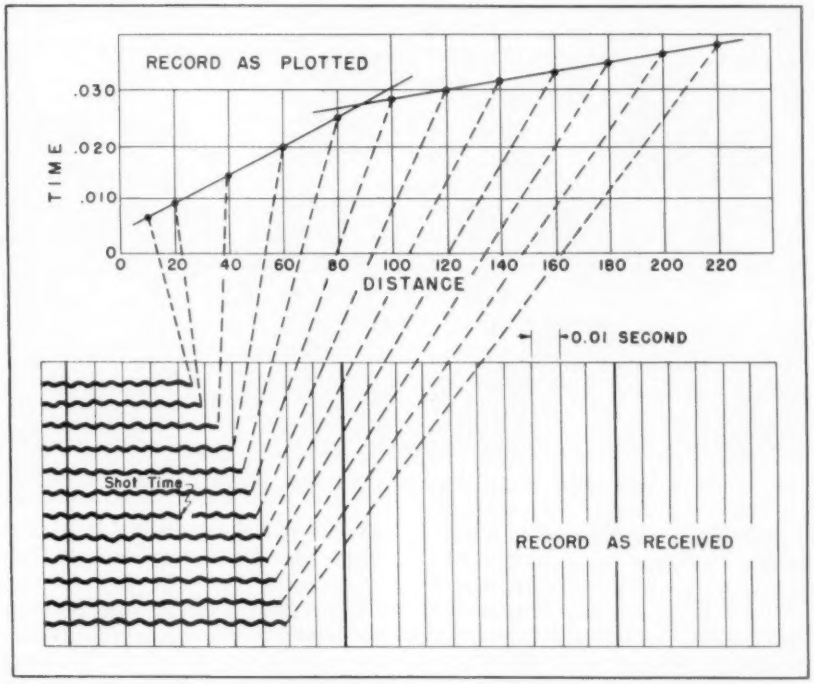


FIG. 3. Seismic oscillogram and data plotted from it. Plotting and interpreting data are highly important in securing fully satisfactory seismic results.

The field operation of the seismograph requires the services of two professional-grade men: An instrument man who supervises the field operation and takes the seismic record, and a geologist who interprets the seismic records and correlates their information with the data from geological field observations. These two men are assisted by a crew of two to four men who handle the seismic lines, lay the cables and plant the geophones or "jugs" below the sod. This labor gang also bores a hole for the explosive at each end, and sometimes in the middle, of each seismic line. The explosive handling, of course, must be done with proper safety precautions by a licensed blaster.

The sequence of operations is to set up the portable seismic equipment, in our case furnished by the Century Geophysical Company, of Tulsa, Oklahoma; the location of the recorder is usually near one of the shot points, but sufficiently far from it so there is no hazard from the small explosion. While the instrument man is setting up his equipment, the line men are unreeling the seismograph cable with its 24 conductors along the shot line which has previously been located. The geophones are laid alongside each take-out of the seismic cable, a small hole is dug below the sod or disturbed surface level, the geophone is firmly placed in the bottom of this shallow hole and its polarized lead wires are properly connected to the take-out points on the cable. This gives a

TABLE 1—SEISMIC VELOCITIES

	Range in ft./sec.
Sand and gravel	1000—4000
Sand and gravel saturated	4000—6500
Clay	4000—9500
Till or "hardpan"	5000—9500

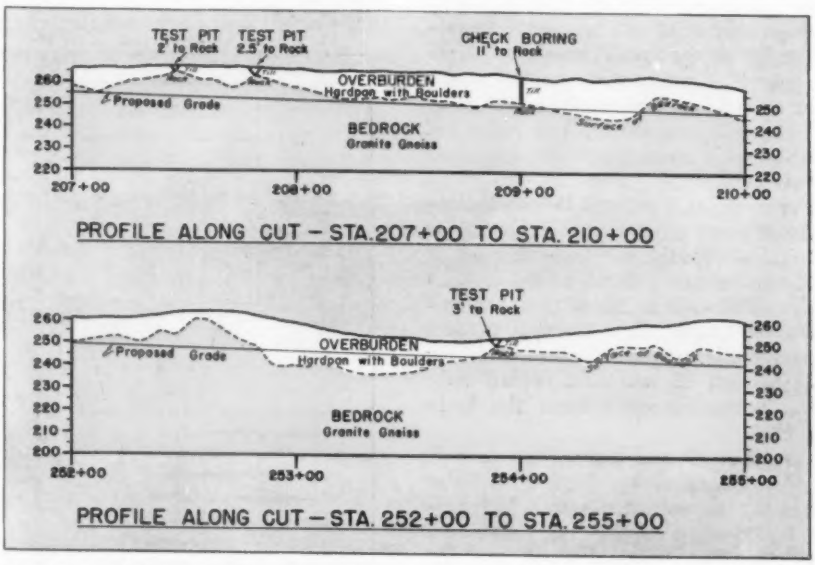
direct connection from the geophone through the cable to the amplifier.

The man responsible for boring the shot hole unreels a separate shot line from the instrument location to the shot point. The explosive is taken from the magazine by the blaster, planted in the blast hole, tamped in place, and when all is ready the lead wires from the explosive are connected to the shot line. While the explosive is fired through a shot line separate from the geophone cable, a record of the shot firing is impressed on the same camera record as carries the seismic record from the geophone. The use of 24-conductor jumper cables permits the instrument setup to be located at a central point and the shot lines to be extended from it to a distance of a thousand feet or more. Where visual signalling is impractical because of brush or terrain, the use of sound powered telephones keeps the blaster in contact with the instrument man up to the moment of firing the shot. The telephone serves as a convenience and a safety medium.

Field Use Advantages

The field use of the refraction seismograph has proved to be advantageous from the standpoint of speed and economy in a number of cases. The recent use of this method of exploration on the Greenwich - Killingly Expressway in Connecticut made possible a considerable saving on subsurface exploration for the sections where cuts are to be made. The results reported here are based on work on Section 28, the contract for the design of which is held by F. P. Molloy, with Alfred M. Kaehrle in charge. A series of cuts reaching a maximum depth of 38 feet and a cut length of approximately 7500 feet made it necessary to know the amount of rock and overburden to be expected at the excavations. As many of these were side hill cuts with the rock at substantially different elevations under the gutter lines, which are normally 98 feet apart, sections across the expressway were as desirable as sections along the construction line in order to show all conditions.

The method of exploration planned by Mr. Kaehrle was to run seismic lines along both gutters profiling the rock along these parallel lines. Continuous profiling is possible by the seismic method where the combination of good records, experienced interpreters and known geology exists. The length of single seismic lines ranged from 100 feet to 500 feet; the length of each line being designed to give the maximum amount of information at the particular site. A significant item of concern was the presence of many boulders, some of them of enormous size in the glacial till, which was the typical overburden. These boulders resulted in irregular seismic records from short seismic lines, thus showing the present boulders, and longer seimic lines were then used to resolve the bedrock surface. The combination of seismic lines needed to secure the desired information resulted in the overlaying of seismic lines of different lengths so that a considerable part of the profiling is the result of shooting more than one seismic line over the profile distance. Also, at points especially selected to determine slope of the rock surface or to detail a critical area, seismic lines were run along the center line and across the right-of-way. Sample profiles of the report on this project are shown in Figure 4.



● **FIG 4. Bedrock profiles in a difficult area are determined by seismic means. Check borings at places indicated showed the depth to be properly interpreted.**

Seismic velocities have a range for each type of material and some of these ranges coincide or overlap. In territory geologically unknown or where conditions are obscure it is highly desirable to supplement seismic information with a limited amount of test boring. This in effect makes the seismic survey an interpolation between widely spaced drill hole locations. One drill hole for each 1000 feet to 2500 feet of seismic line is likely to be adequate for most purposes. Where, however, the soils engineer must have specimens with which to make laboratory tests a greater density of drill holes will be necessary.

The Massachusetts Department of Public Works has a cooperative arrangement with the U. S. Geological Survey under which the Survey provides or assists in providing seismic information on preliminary location and for design of highways in the Commonwealth. Drilling is undertaken for the structures when design stage is reached.

Another use for seismograph information is in site planning. The judicious use of a few seismic lines with good geological reconnaissance will often provide the basis for a plan which will permit the most economical construction with the advantage of optimum service from the facility. Close cooperation between the architect, design engineer, soils engineer and seismic party may permit the preliminary exploration to be combined with sufficient detailed exploration to provide design criteria as a part of one exploratory program.

Where the Seismic Survey Pays Off

Buildings: Differential settling is the principal hazard where parts of a heavy or extensive building are set on different kinds of earth materials. Seismic means can quickly identify the continuity and character of the bearing area so that allowances can be made in advance for any differences which occur. For example, the depth to bedrock and the shape of its sur-

(*Continued on page* 148)

Taming a Traffic HOT SPOT

ONE of the World's most concentrated traffic "hot-spots" is in Dearborn, Mich. In eight hours over 137,000 cars pour in and out of Ford's River Rouge plant onto Schaefer Road in Dearborn. Heretofore, trained horses and mounted policemen have been freely perspiring in a continually nervous but bold and dangerous effort to control this concentrated mass of drivers.

Now modern signal lights and push buttons on panels illustrated with the intersection and with each desired tailormade phase of control are housed in glass enclosed 25 ft. towers. Intelligently operated from this exceptional vantage point, the operator now converts and untangles this mass into smoothly flowing, easily controlled lanes of traffic.

If a driver emerging from or entering one of the four gates fails to follow the signal directions, the control operator's amplified voice guides him back in place. These voices originate from powerful speakers, one on each of the four towers.

This new system was set into full operation last November by Mayor Orville L. Hubbard of Dearborn, who, in view of state, county, and city officials, pushed the first special control button. Mayor Hubbard asserted, "This system is the first of its kind in the country. It is especially designed to handle the Ford plant traffic."

Marguerite C. Johnson, director of public safety likened the development of the system to "necessity being the mother of invention. The officer on horseback or foot could no longer safely and efficiently direct the tremendous volume of traffic emerging from and going into the Ford plant from Schaefer road. The present towers and traffic system, which were devised under the direction of the City of Dearborn's Superintendent of Communications, Marion Henry, are the answer to a very tricky problem in vehicle control at the Ford plant gates on Schaefer Road."

The problem was to allow as many as 17,000 autos at one gate to leave the plant safely in a three-hour period with a minimum of confusion. Michigan State officials determined that to do the job correctly, four phases or traffic movements were necessary. To compound the problem it was discovered that these phases or movements must occur where the traffic was heaviest in order to move the maximum number of cars in the shortest time.

This ruled out automatically controlled equipment since the volume of traffic is so high, normal counters could not keep up with the flow. Cars approach the intersection bumper to bumper from all directions. Therefore the lane of traffic with the heaviest concentration of cars had to have the right-of-way. The state officials reasoned that manual operation for the selection of the right-of-way seemed the only answer to the problem.

● **NEW SPAN-wire signal installation at Gate 10 of Ford plant. Control tower is shown at left. There are signals for each lane.**

Eagle Signal Corporation of Moline, Illinois, was asked to see if they could solve the problem of designing such equipment. This equipment had to move traffic, but it had to be dependable, easy to service and as flexible as possible. With these premises in mind, the engineers designed each intersection control around one type of

● **GLASS enclosed traffic tower gives officer a clear view in all directions.**

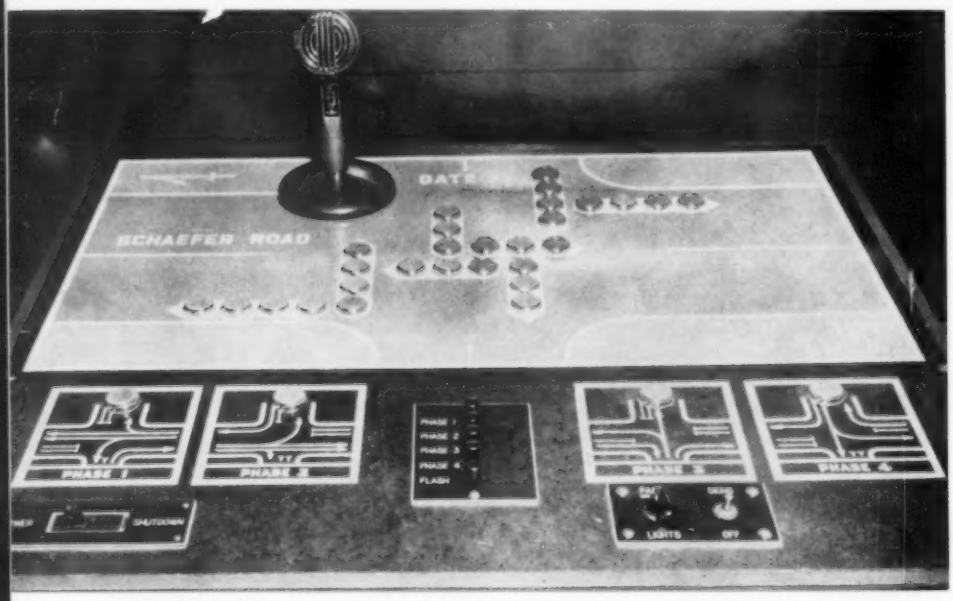
master control panel, containing all the control relays and timers. The master panels could then be used, interchangeably at any of the four intersections. The reason for this was simplicity of design as well as maintenance.

Supplementing this main panel were two others. The first supplied flashing amber power to the signals facing the main street and flashing red power to those facing the plant gates during time in between shift changes.

The second panel shows a drawing of the intersection with colored pilot lights in the same positions as the traffic signals they represent. This enables the operator to check at any time which lane of traffic has the right-of-way. Beneath the intersection layout are small diagrams of each of the possible traffic movements. Each of these diagrams has its own pilot light to indicate when it is in use. Also on this panel are all the controls for operation of the equipment. There are switches for controlling shutdown, sign lights for traffic lane control and the panel lights. The main control is a manual pushbutton station with a button for the selection of each of the different traffic phases.

In operation, the traffic officer selects and operates the button for the traffic movement wanted. The control panel then takes over and picks which signal light will go to amber and actually times the length of the amber warning period. Then it actuates those lights necessary to establish the new traffic movement. During this period, the panel takes control away from the operator to insure proper timing of the amber period.

Other safety features include a provision that in case of failure of any of the relays in operation, all the lights will show red. Thus there is no possibility of two different lanes getting the right-of-way at the same time. Also due to the simplified design, using three panels allows the maintenance man to place the equipment in flashing operation and to replace the whole control panel with signal indication still on the corner. He can then inspect the removed panel at his leisure. Components are so mounted on the panel that each can be replaced or inspected easily.



● **CONTROL panel, designed by Eagle Signal, permits officer to see at glance which traffic movement to select. Microphone is for giving verbal instructions.**

At a meeting following the opening ceremonies at Gate 10, state and municipal engineers from all of Michigan were present. Mayor Hubbard paid tribute to Marion Henry, Mrs. Marguerite Johnson and Mathew Porosky, President and General Manager of Eagle Signal Corporation, for the successful solution of a problem that had theretofore been deemed impossible.

• • •

Information Regarding Radioactive Isotopes

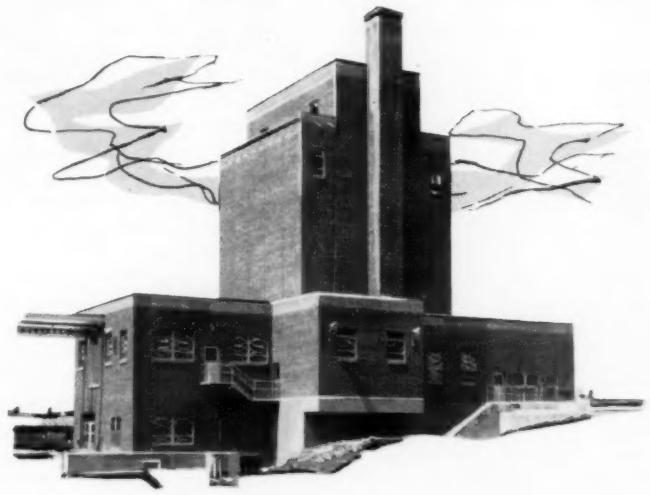
Radioactive isotopes are chemically identical with their stable counterparts. They behave in the same way in chemical reactions, and are handled in the same manner by physiologic and metabolic processes. It is possible to follow them through all sorts of procedures and reactions and to trace the paths of their nonradioactive twins.

The rate of disintegration of these substances is commonly expressed by a statement of their *half lives*. The half life is the period in which half of all the atoms of the particular isotope present will have disintegrated; in the next half period half the remainder will go, and so on. Thus, about seven half lives are necessary to reduce any given amount of an isotope to one percent of its initial value. Half lives of various isotopes range from fractions of a second to millions of years; for those useful in medicine, for the most part, half lives vary between a few hours and a few weeks. Radioactive potassium (K^{42}) has a half life of 12.4 hours; its period for reduction to one percent is about 3.5 days. Radioactive phosphorus (P^{32}), with a half life of 14.3 days, will not be reduced to one percent until over three months have elapsed.

The amount of any radioactive isotope is expressed in terms of curies, or millicuries, or microcuries, the last being the normal one for diagnostic procedures. A microcurie of any isotope is that quantity in which 37,000 atoms disintegrate per second. If an isotope has a long half life, a microcurie of it will have to contain more atoms than if it has a short one, to keep up the supply for disintegration. As the amount decreases by this disintegration, what was originally a microcurie becomes less, but the reservoir has to keep up the supply for whatever the natural rate may be.

Radioactive isotopes emit beta or gamma radiation, or both. The beta rays may be so unpenetrating that a small fraction of a millimeter of tissue will stop them all, as in radioactive carbon and sulfur, or they may traverse several millimeters, as those from radioactive phosphorus do. The most penetrating beta rays, known to be emitted by a radioactive isotope with a half life of more than a few minutes, are those from radioactive potassium, with a maximum range in tissue of nearly 2 cm. Gamma-ray energies range from less than 100 kv. in radioactive iron, to more than 2,000,000 volts in radioactive sodium.

It is evident that both the lifetime and the kind of radiation emitted by an isotope will be important considerations in the types of investigation that can be made with it. Obviously, a study extending over several days cannot be made with an isotope having a half life of a few minutes—*Navy Medical News Letter.*



Construction of a Completely New Treatment Plant

A NEW water plant was dedicated in April of last year in Warren, O., the first city to be lighted by Mazda lamps, and where the first Packard automobile was made. The plant is designed to supply 15 million gallons on an average day. The present population is about 50,000, but the design anticipates an increase to 83,000 in fifteen or twenty years. Everything in the plant is new, and new feeders and new mains have been added to improve the distribution system.

Warren was the first county seat in the Western Reserve, and preserves its dignified air along with many fine old residences and public buildings. The City Hall stands back in grounds reminiscent of early days: a solid three-story brick building. As befits a capital it is surrounded by smaller brick buildings which house various departments of the city government. The open areas inside, which once provided hitching space for horse-drawn vehicles, are now arranged for parking many cars along the curving roadways through well kept lawns.

The water demand is built up by industry, normal domestic use, air conditioning and sprinkling. The unknown quantity is how these four factors in the total demand may pyramid to a peak. So far they have never combined to make a prohibitive load, but such a possibility is a limiting factor in design. In 1953 the maximum daily pumpage was 3.57 mg or 35 percent higher than the average and 8.06 mg or 142 percent more than the minimum.

A substantial two-story brick building housed the old water plant. Changing times have made it a hazard on its corner where an important street meets a through highway. Joseph C. Hapgood, Superintendent of the Water Department for the past ten years, and employed in other positions in the department for 22 years before that, has recommended that the old building be converted to a storage plant. His long-range planning has brought about all of the improvements just cut into service.

The old plant was expected to supply 8½ mgd of water drawn from the Mahoning River and treated to unquestioned purity by standard processes. Toward the last it had to produce 14 million gallons through some periods, 60 percent above its design capacity. Now it is retired from service, and the anxiety about getting enough water through the distribution system is ended.

The new plant is complete from raw water supply to distribution. In their summation of purpose, Havens and Emerson, consulting engineers of Cleveland and New York City, say: "The raw water will be treated, for the removal of turbidity and color, by the addition of chlorine and alum, followed by rapid mixing, flocculation and settling. The settled water will be passed through rapid sand filters, to a clear well from which it will be pumped (after post-chlorination for complete destruction of bacteria) into the distribution system."

In addition, lime or soda ash is introduced to supply any needed alkalinity, and also to control the pH of the finished water. Activated carbon is used in the treatment to remove tastes and odors. The water is not softened.

Raw Water

A new source of supply was found in the Mosquito Creek Reservoir, northeast of the city. This reservoir was constructed by the U.S. Corps of Engineers in 1943-44 as part of a flood control project. It drains about 98 square miles, and stores

● **ELEVATED water tank of million-gallon capacity is essential part of plant. New service building in rear.**

● **OPENING day: L to R, Mayor Burbank, Mr. Havens, Mr. Hapgood and Mr. Hruschka at the control panel.**

104,000 acre feet. The city is to pay $4.50 per mg for water drawn from the reservoir, measured by a Venturi meter installed at the raw-water side of the filtration plant.

This water is superior to that formerly drawn from the Mahoning River, and is more constant in character. The two waters are compared in Table I in parts per million of elements.

Table 1—Water Characteristics

Character	Mahoning River	Mosquito Creek
Turbidity	22	20
Alkalinity	71	45
Total hardness	177	65
pH	7.9	7.5

The pumping station is located at the reservoir on land leased from the U.S. Engineers. Water is available on demand, and flows into the pumping station through one of three existing 36-in. square intake ports. These ports are protected by bar screens with 2-in. clear openings, and the screens are kept clean by the Engineers.

When the flow is by gravity it will pass through a traveling screen having ⅜-in. square openings ahead of the pumps. When the flow has to be raised to the pumps it will by-pass the traveling screen, and the pipe line will act as a suction line directly from the reservoir to the pumps.

Four Fairbanks-Morse centrifugal pumps are installed. Three are motor driven; two of them 5 mgd and the other 8 mgd. The standby is a 10 mgd pump driven by a diesel engine. The total pumping head on each pump will range from 3 ft. to 30 ft., with the capacity head established at 18 ft.

The only responsibility of the city at the reservoir is the control of algae, which grows luxuriantly, and this is accomplished with a barge which applies copper sulphate.

Water will be pumped to the filtration plant through two 30-in. pre-stressed reinforced concrete mains, each about 3000 ft. long. These are so valved that either one can be used alone. They are joined in a single 36-in. line just before entering the chemical building. Here the Venturi meter is installed as one of the requirements of the U. S. Engineers.

The mains were laid by a joint company composed of the National Construction Company and the Utilities Construction Company, both of Cleveland, at a contract price of $1,444,415.

Filtration Plant

The operating plant is located on 50 acres of city property about four miles away, on a highway and railroad. It is designed for a normal filter capacity of 15 mgd, and a maximum capacity of 24 mgd. The six-story chemical building makes the plant distinctive, and provides for direct feeding of chemicals from the bin floor down. The plant, with the raw water pumping station, cost $3,388,865, and both were built by the Bass Engineering and Construction Company of Birmingham, Michigan.

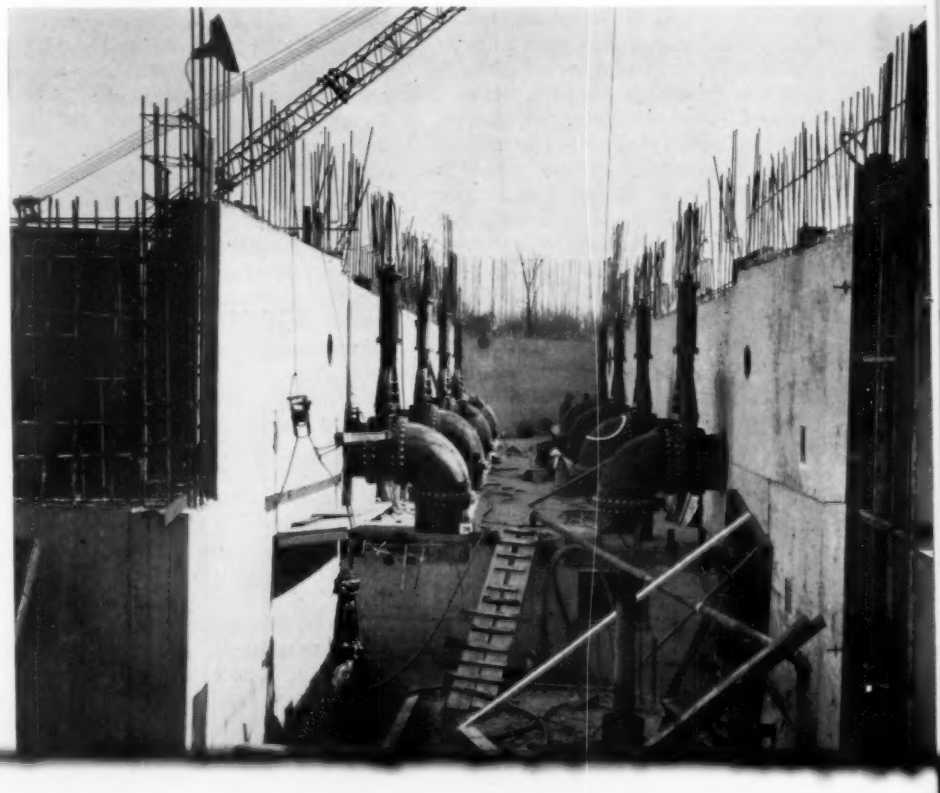
Chemicals are received by rail or truck and elevated to the bin floor, where they are distributed to the several bins by a reversible screw conveyor. The unloading and distributing system handles 8 tons per hour. Activated carbon is moved on skids, 40 bags weighing 1400# per skid, and fork lift trucks. The one-ton chlorine cylinders are carried on a monorail between cars or trucks, storage and scales. Storage is provided for 173 tons of alum; 86 tons of lime and the same for soda ash; 15 ton-cylinders of chlorine, and 17 tons of bagged carbon. This is enough for a 30-day run at design capacity.

This amount of storage space was accepted only after considerable discussion. It was decided to design for this amount, and pay demurrage on railroad cars on the siding when necessary. This is expected to be more economical than to spend more money for permanent storage space in a building.

There are two feeding units each for alum, lime, and soda ash. These are of the gravimetric belt type. Alum can be fed at the rate of 500 pounds maximum and 50 pounds minimum, lime and soda ash at 200 to 20 pounds. Carbon is fed by two feeders, gravimetric loss-in-weight type, at rates of 50 pounds maximum to ½ pound minimum. The carbon hopper will hold 3200 pounds.

Chlorine is fed to raw water mains, effluent of settling tanks and

(*Continued on page* 122)



● **CONSTRUCTION: This view shows the pipe gallery, with reinforcement in place and some of the walls completed.**

Only Modern Waste Collection Programs

Can Use Labor Efficiently

Labor costs have been held to a minimum in developing this village's waste collection program by providing crews with packer trucks, equalized collection routes and offering employees an incentive for extra earnings.

FLOYD F. WILCOX,

Trustee and Commissioner of Public Works, Lynbrook, N. Y.

Behind a plow and mule a man will reach a certain level of economic efficiency — somewhere around 40 acres, I've heard. Put that same man on a tractor and his level of economic efficiency increases at least fourfold.

That example illustrates figuratively, though roughly, why I believe that no village can afford to be without modern waste collection equipment and methods. There are many good arguments for modern waste collection practices, but I believe the best argument is the level of economic efficiency that can be achieved by the men who actually have to make the system work.

Our present waste collection program, which we started to plan in 1946, is based on the economic fact that the abilities of men are best utilized, and at the lowest cost, only when they are provided with (1) the proper tools of the trade, (2) a proper division of labor and, if possible, (3) an incentive for extra earnings. The efficiency that our men have achieved because of these three provisions not only has let overall operating efficiency take care of itself but has given us a waste collection program which I believe is as modern and economical as any in the country.

Because our waste collection program is based on the efficient use of labor as the key to overall operating efficiency, perhaps the development and results of our program will be of interest to others.

Our first provision in 1946 in planning a modern waste collection program was the proper tools of the trade. Our open trucks, nursed through the war years, were in need of replacement. Before replacing them, we decided to review the experiences of other cities with collection equipment. With labor our biggest annual cost item—and wages increasing—we wanted to be sure our choice of equipment would utilize labor most efficiently.

The immediate result of this review was the conclusion that our open trucks actually were decreasing the economic efficiency level of our men as wages increased. We couldn't expect collection crews with outmoded equipment to give us the same kind of production that

● **MR. WILCOX at his desk; above, crewmen at work with one of Lynbrook's modern collection vehicles.**

was being reported with modern packer trucks.

More Efficiency

We concluded our review with a study of modern waste collection equipment based on the most efficient use of personnel. The end result was our purchase of three 12-yard Gar Wood Load-Packers. Their low loading height, simplicity and speed of operation and safety features were made to order as efficient tools of the trade. The three units were placed in service in January, 1947, and the labor advantages of such modern equipment on the efficiency level of our collection crews was soon apparent.

First, our men were able to get more done because they could load any and all waste faster. Second, easier loading eliminated the strain of lifting waste containers into high bodies, so that the efficiency of our men didn't fall off because of work fatigue as the end of the work week neared. Third, injuries due to equipment were eliminated, so no time or expense was lost by having men on sick leave. With open trucks, injuries were common because of dropped containers, slips or falls in climbing trucks, and ruptures due to high lifting.

Our benefit down the line was economical labor costs, and the primary objective of increasing the efficiency level of our men just naturally increased our general operating efficiency. We could handle more waste with fewer men and less equipment because of highly compacted loads, and less travel time and expense was incurred in hauling to incinerator or dump.

Today we operate four 12-yard and two 16-yard Load-Packers (one is a spare) with three-man crews to serve our approximately 25,000 people. The two 16-yard packers, one purchased in 1953 and one this year, the latter to replace a 12-yard unit which was sold to another community, were purchased to obtain even more efficient operation. Since it takes our trucks an average of 45 minutes to make the round trip from our village to the incinerator we use, bigger loads mean fewer trips, and, consequently, reduced non-productive travel time of trucks and crews.

The second provision we made to utilize our crews efficiently was a proper division of labor. Our waste collection schedule, based on a six-day work week, calls for two residential collections a week of both garbage and rubbish and daily business collections of all waste. In order to maintain this schedule, we divided our village into five collection routes, and we combined our residential and business collections in this division. Each route handles part of the business section every day.

Our reason for this residential-business route division was to give each crew as equal a share of the residential and business waste collection load as possible. No crew has to lift more, carry more or walk more than any other, so job fatigue and dissatisfaction because of route favoritism don't decrease the efficiency of any crew. Consequently, our overall operating efficiency doesn't suffer.

Salvaging Privileges

Our third and final provision to develop more efficient crews was an incentive for extra earnings through salvage privileges. We allow our men to salvage rags, waste paper and scrap iron. Although this policy may not be practical in all communities, we have benefited two ways.

The extra money our men earn from the sale of the salvage has developed happier crews. We save money in the long run because they work better and our labor turnover is almost nil.

Although we allowed salvage from choice since it's a natural human trait, it's now dictated by sound economics. We have to pay $5 for each ton of waste we dump at the Town of Hempstead's Merrick incinerator, which we use along with other villages. Each ton of waste paper the men salvage saves us money that otherwise would have to be spent.

Crew salvage actually has increased the efficiency of collections, too. In order to facilitate salvage and save incinerator costs, we require newspapers, magazines and similar paper to be securely tied in bundles. It's then a simple job, compared to handling loose waste paper, for the men to pick up the bundles and stack them on top of Load-Packers or between the truck cab and body. Salvaged waste paper also provides more room for more collections. The salvaged paper is dumped with no appreciable loss of time at a central location maintained by the men on the way to the incinerator.

The cost of operating our system during 1953 was approximately $120,000—a per capita cost of $4.80—for two household collections each of garbage and rubbish every week and daily business collections. We collected 7050 tons of combustible waste last year not including the tonnage of waste paper salvaged by our crews. Rubbish, which we dispose of at the Town of Hempstead's Elmont dump, in Franklin Square, N. Y., amounted to approximately 2000 loads in 1953.

As successful as the development of our waste collection program has been, however, it would not be as efficient as it is without the cooperation of our citizens. We constantly have backed up each step in our methods and policies by keeping people informed of our regulations and reasons.

Our chief vehicle for this information is our village's monthly newspaper, "Your Lynbrook Month by Month," which provides news of village operations. Our department regularly submits articles and news on the highlights of our waste collection program in order that our citizens better understand what we are doing and why. Understanding has produced the kind of cooperation we need in promoting efficiency.

• • •

The Structural Design of Concrete Roads

Present knowledge of the thickness, length and width of concrete road slabs, the use of reinforcement and the function and design of joints is reviewed. The factors causing stresses are considered; it is thought necessary to rely on experience and experiment when making recommendations for future designs because it is not possible to calculate stresses caused by phenomena other than wheel loads, temperature gradients, and changes in the mean temperature of the slab. The thicknesses of concrete surfacing recommended for five different traffic conditions and three qualities of subgrade are tabulated. The strength properties of the soil are thought to be of less importance than the uniform behavior of the soil and the avoidance of differential deformations. It is contended that the base is only useful on poor soils and for resisting the effects of frost. Recommendations are made for joint spacing and consideration is given to the position and amount of reinforcement used; recommended quantities for different soil and traffic conditions are tabulated. The functions of the various kinds of transverse joint are discussed and details are given of suitable designs for transverse and longitudinal joints.—F. N. Sparkes in the Magazine of Concrete Research, from British "Road Abstracts".

NEW BRIDGE

USES SLABS PRECAST ON BARGES

IN building the Dauphin Island Bridge across Mississippi Sound, the contractors and the Alabama Highway Department have used two major construction innovations. One is precasting the reinforced concrete roadway slabs in reusable steel forms on specially constructed barges; the other is the use of paper forms for encasing the steel bearing piles with concrete.

Alabama Highway Dept., requires per cu. yd.: 541 lbs. of cement; 135 lbs. of fly ash; 1094 lbs. of sand; 1728 lbs. of gravel; 3 percent entrained air; and 38.9 gals. of water. There will be required 345 of the 34-ft. slabs, of which 342 will be cast on the barges and 3 will be cast in place.

Development of the barge-mounted forms into which truck-mixed

dling slabs onto barges for delivery to the site. and the hazards of pouring in place in an open stretch of Gulf Waters intermittently subjected to sudden and severe blows and storms.

Six barges are used on the job and three of the 29 x 34 foot slabs, each weighing 65 tons, are poured on each barge by Radcliff Gravel Company at its main waterfront

● **POURING concrete for roadway slabs into steel forms mounted on barges which float the slabs to the bridge site.**

● **SONOTUBE forms permitted easy pouring of concrete to protect piling from below ground line to above water level.**

The bridge is part of a 4.4-mile project which includes 2.165 miles of steel and concrete bridge and a 210-ft. lift span with an 85-ft. vertical clearance. Designed for an H-15-44 AASHO loading, the width is 29 ft.—a 24-ft. roadway, two 6-in. curbs and two 2-ft. walks. Spans are 34 ft. The concrete mix design developed by J. A. Hester of the

concrete is poured 27 miles from the bridge site, was worked out by the contractor and representatives of Irvington Form and Tank Company of New York, who built the 10 gauge sheet-steel forms. Use of the ingenious forms built onto the barges eliminates the problems of setting up a casting yard and casting in forms on shore, of rehan-

plant on the Mobile River in Mobile, 27 miles from the site of the bridge. In all, 9,890 yards of concrete will be poured by Radcliff. Their mixing trucks run about 75 feet from the batching bins to dockside with a four to six-minute interval for mixing. A Lorain crane handles a one-yard Insley laydown concrete bucket between the trucks

● **FOUR-PILE bents of pilings for Dauphin Island Bridge are shown here fully protected with concrete poured in Sonotubes.**

and the barges. Slabs are screeded and belted and cured with Hunt Process clear curing compound.

At the bridge site a slab-placing traveler, designed specially for the project and equipped with a Skagit hoist, travels on its own tracks as the bridge grows, reaches down between the pile bents and connects its lifting beams to eight lifting eyes screwed into coil anchors cast into each slab. Just before the hoist takes the load, air pressure is applied through large diameter hoses placed under the soffits to break the bond and pop the slabs loose from the forms. The hoist lifts the slab above the level of the roadway; the slab is then revolved through 90 degrees and lowered into place on the already constructed concrete caps. In this way it is possible to get the barges between the bents which are 34 feet apart.

First one end slab, then the other, and finally the center slab are lifted from the barge, in that order, so that the barge remains as nearly level as possible during the lifting operation. The application of the bond-breaking air pressure to the girder soffits is the secret to the success of the entire operation. Average time for lifting and setting a slab in place is 50 to 55 minutes, including drilling holes and placing dowel pins into the caps on the fixed end of each slab. Curbs are poured after the slabs are placed.

Slabs are set in place five to six days after pouring. The form clean-up starts as soon as a slab is lifted out of a barge at the bridge site, and turn-around time for a barge is about nine days.

Steel reinforcing for the precast roadway slabs is tied into cages in special false forms on the bank of the Mobile river and the entire cage for one slab is lifted from the false form and lowered into place on the barges by a Bucyrus crane. The barges are then towed to the Radcliff plant where the concrete is poured.

Piling Encasement

The piling encasement procedure is based on a job-developed air and water jetting device which permits seating the concrete encasement for the piling two feet below the ground line which varies from one foot to sixteen feet below the water line. Development of this device made it efficient and economical to use the 20-inch diameter circular encasements rather than the standard 16-inch square encasements.

Each paper form or Sonotube is fitted with a wooden bottom shaped to fit the H-shaped piling. The form is then set in the jetting cage which extends two feet below the bottom of the tube and which has six jets. The ground line is sounded and the jetting cage, Sonotube and reinforcing spiral slipped over the upper end of the piling.

Encasement concrete pouring begins with the bottom of the Sonotube just above the water line; the weight of additional concrete carries the device to the bottom as pouring continues, consequently all concrete is placed in the dry. A mandrel trips the jetting cage as it reaches the ground line and when the full encasement, its length pre-determined by the sounding, has been poured it is topped off one foot above the water line and the jetting cage is recovered.

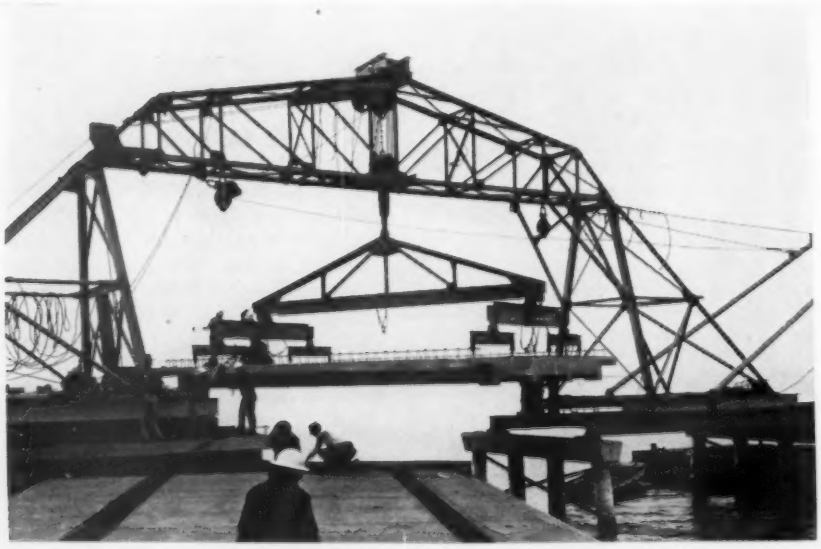
Presence of the sway braces makes it more efficient to pour the remaining part of the encasing concrete, which reaches to within one foot of the top of the piling, as a second operation since the Sonotubes must be slit and notched to fit these braces. The paper tubes are easily cut with an electric circular hand saw, fitted over the sway bracing, and then clamped with iron ratchet type column clamps into position around the pilings.

Another advantage of the paper forms is that they eliminate external curing and they also keep the fresh concrete from exposure to sea water.

The bridge was designed by the Alabama Highway Department, John W. Chambers, Chief Bridge Design Engineer, and construction is under the control and inspection of the Department with Fred A. Robison in charge at the site. Frank W. Currey is General Superintendent of Construction for Blount Brothers-Kansas City Bridge; Russell Thompson is Field Superintendent; W. D. Tryon is Project Engineer; Bruce Johnson is Office Engineer; F. W. Dushane is Office Manager; W. W. Morton is Master Mechanic; S. S. Smith is Carpenter Superintendent; and H. H. Naylor is Superintendent of Slab Casting.

Bridge railing will be Armco type flexbeam hand rail with structural steel posts bolted to the outside of the spans. Four fishing ramps outboard from the bridge proper are being provided and there are two "humps" for small boat clearance. The northernmost gives 16-foot vertical clearance at mean low water and 32-foot horizontal clearance. The hump south of the lift span gives 26½ foot vertical clearance and 40-foot horizontal clearance. The slab over this hump will be cast in place. Parking ramps are provided on each side of the lift span with the roadway slab adjacent to these ramps being of special design and poured in place.

Communication on the job is maintained through the use of a Motorola radio network connecting tugs, major operations, office and superintendent. Portable sets are available for isolated operations.



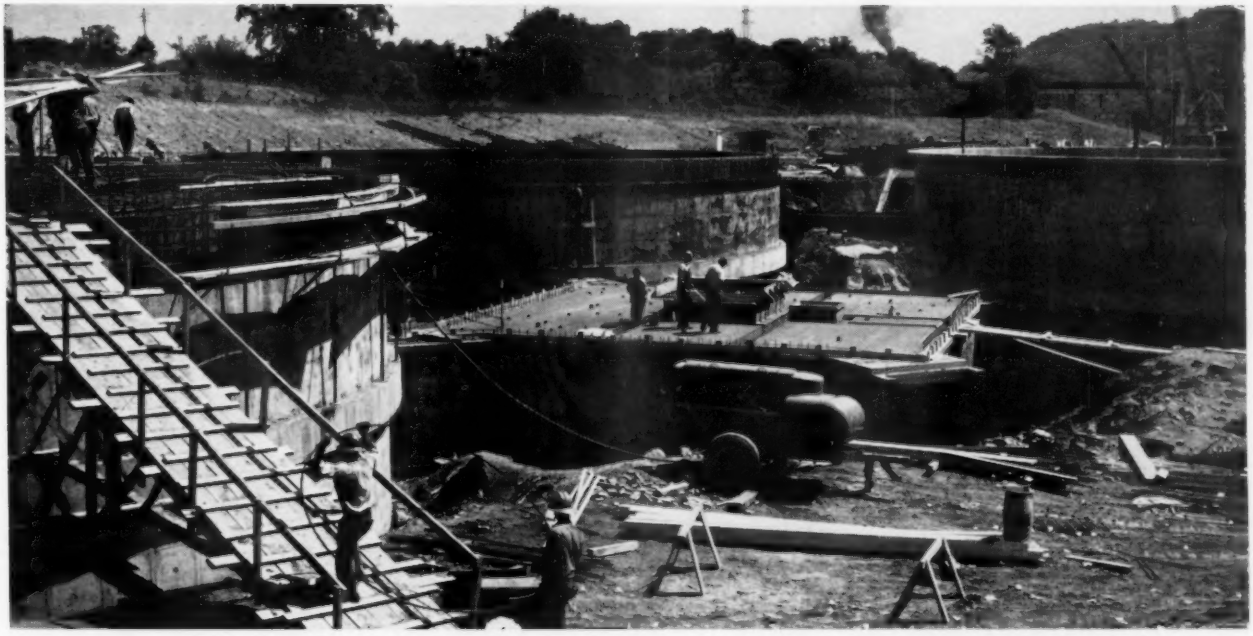
● 65-TON roadway slab is being lifted from barge for placement on bridge piers already in place. Barge has reusable steel forms and holds three complete slabs.

• • •

Water Is 10 Cents a Barrel

Persons hauling water from the Norwood, Colo., supply will be charged 10 cents a barrel.

KNOXVILLE'S THIRD CREEK DISPOSAL PLANT



● **DIGESTER control building is in center and the digesters are at left and in rear. The three digesters are 75 ft. in diameter.**

GUY BROWNING ARTHUR

FIRST of the four large cities in Tennessee to abate its stream pollution problem, Knoxville is building a complete system of sewage interceptors and a disposal plant. This follows the program adopted by the State Stream Pollution Board in 1954, and is another step in the cultural development of the Tennessee Valley. Through the entire history of the city it has discharged its sewage into the river through 32 outfall lines ranging from 8 to 60 inches in diameter. This might have continued except for the progressive improvement of conditions in the area. Also, as one lake after another has been formed behind dams constructed for taming the river, water from Fort Loudoun Lake is backing up far enough to flood some of the islands at Knoxville.

To continue to discharge 25 MGD of sewage into the lake would create a nuisance. This flow comes from 29,000 sewer connections in the city and 500 more outside. Added to this is the discharge from the Fountain City Sanitary District—said to be the largest unincorporated area in the country—which will reach one million gallons daily very soon. The total is not a design capacity for the new system, for Knoxville is growing rapidly.

When the state agency adopted its program in 1954, Knoxville retained Greeley and Hansen, consulting engineers of Chicago, to make a study of conditions. Their report was presented to the mayor and council, and they were instructed to proceed with plans and specifications. These were completed in 1948. In 1951 the voters authorized an issue of $6,000,000 in sewer revenue bonds to finance the project. Work was ordered to begin by September, 1953, under the supervision of the City Engineer.

One of the interesting features of the early plans was to make the administration building large enough to provide laboratory space for the Tennessee Health Department, the University of Tennessee, and the Health and Safety Department of the Tennessee Valley Authority, jointly, to undertake a program of research and experiments in abating stream pollution. Unfortunately this was dropped from the later plans.

Locating the new plant was influenced, however, by the plan for this research laboratory. The plant could not be built on one of the islands, as first proposed, because of inundation by the lake. Nor could it be located on the south bank of the river, a second proposal, because that is a steep rocky ledge. The proper location was on the north bank on property owned by the University of Tennessee. Attention was drawn to it by the idea of the research program. But when the plans were revised to provide only for a city disposal plant, with no outside collaboration, the site was still the best in every way. The land was purchased from the University. While the site is narrow, the result is a compact layout which provides space for present and future needs.

It is easier to concentrate the interceptors on the north bank to serve the major sewer districts. Of the 32 sewer outfalls 26 are on the north side and 6 on the south. The main interceptors will cross all the

● **GRIT chamber under construction; present flow 24.2 mgd; design 35.7 mgd.**

former outfall lines on the north bank, keeping construction costs down. The new system will have 10 miles of interceptors from 10 to 84 ins. in diameter, with two river crossings, two pumping stations, and two treatment plants.

One pumping station, Jones Street, is on the south side, and will pump all the sewage intercepted on that side to the north side main. Another interceptor chamber on the south side will send the sewage of its section across the lake by inverted siphon. The second pumping station, Cheowa Circle, downstream from the new disposal plant, on the north side, will pump up-river to the plant.

There will be two treatment plants, for topographical reasons. Third Creek Plant will handle the flow from 261,000 population, but is designed for an eventual load of 400,000. Loves Creek Plant is designed for a maximum population of 13,250, with a present loading of 7,600. As a preliminary to design, the sewage characteristics were studied carefully. The Loves Creek plant is a small installation on the Holston River to serve an area called Burlington. It was decided to build this plant because it is more economical to pump sewage from this area to a local site than to the large interceptors.

Design Bases

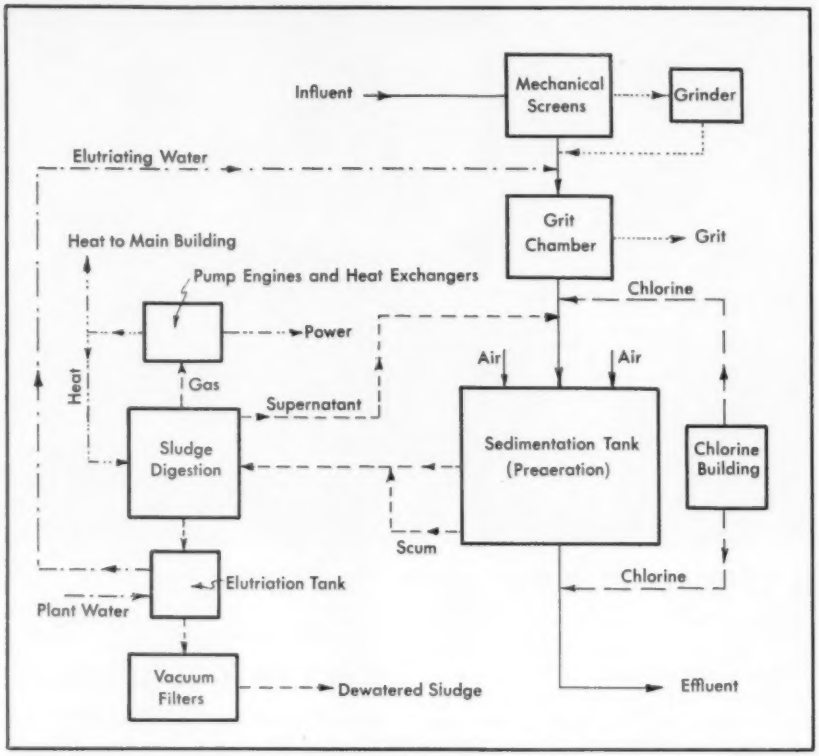
The Third Creek plant is to comprise separate sedimentation and digestion tanks, equipment for dewatering sludge with vacuum filters, and both pre- and post-chlorination, as well as secondary chemical treatment in the future if that is found to be necessary. Present flow is 24.2 MGD; design basis is 35.7 MGD—an estimate for 1965; and ultimate capacity is 50.7 MGD in 1995. The Loves Creek plant will have Imhoff tanks and sludge drying beds, and provision for pre-chlorination. The present flow is 0.5 MGD. The design basis is 1.4 MGD estimated for 1965, and an ultimate of 2.5 MGD in 1995.

Third Creek. This plant will provide primary treatment and chlorination. But the structures will be arranged to provide for chemical precipitation later if that becomes necessary. The structures include the following:

A two-unit grit chamber equipped by the Dorr-Oliver Co. The influent can be sent to either of two wells from the intake. These are separated by a channel 8-ft. wide running all the way across the structure, providing a by-pass.

Four settling tanks 132-ft. long and 43-ft. wide, 14′ to 15′ deep, with Jeffrey sludge collecting equipment.

Three digestion tanks with the control building between. These are 75 ft. in diameter, and 21.25 ft. sidewater depth. One digester has a floating cover, supplied by Pacific Flush Tank Co. The control building is roughly 40 ft. square. It is not structurally connected to the digesters, but has passageways to the digesters for piping. Two elutriation tanks are 42 ft. by 10 ft. and 10.25 ft. deep, built together. Gas from the digesters will be used for the pump engines, the heat exchangers, for heating the main building, and for power generally. Supernatant liquid overflowing from the digesters goes back to the main stream ahead of the settling tanks. Digested sludge is pumped to the elutriation tanks and water of elutriation is pumped back to the main stream ahead of the grit chamber. After elutriation the sludge is dried on vacuum filters, and the de-watered material is wasted.



● **PLAN and flowsheet of Knoxville treatment plant, described in this article.**

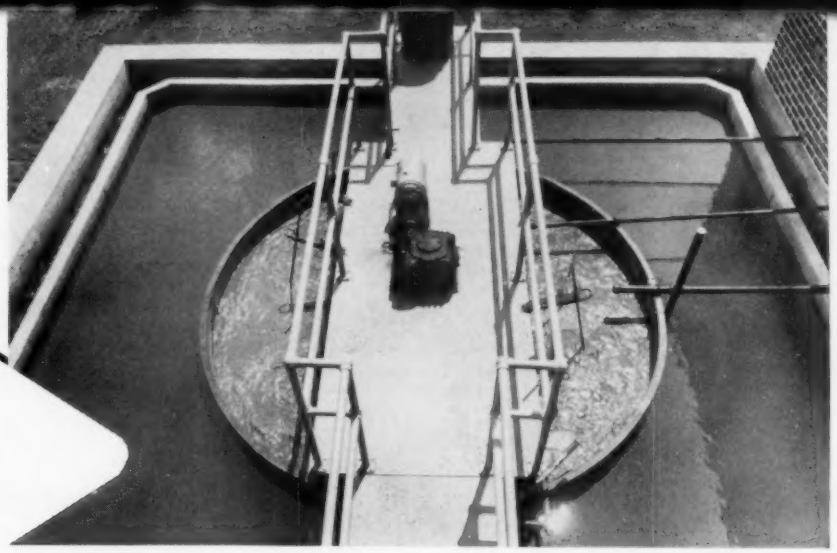
Screens are furnished by Jeffrey Manufacturing Company. All valves are by M & H. Sluice gates came from Rodney Hunt; hoisting equipment is by Tramrail Corporation; the platform scales are supplied by Fairbanks-Morse.

The main building contains the bar screens and grinders, the wet well, pumping equipment, sludge filtering units, and the usual offices and laboratory, with an assembly room.

Loves Creek. This small plant has a detritus tank for grit removal, and screens. The screened sewage is pumped at a constant rate into the

(*Continued on page* 148)

WATER FOR THE MISSISSIPPI DELTA AREA



FOR delivering plenty of clarified and safe water to people living in an area extending for 22 miles along the Mississippi River in St. Charles Parish, La., two new water works plants have been built. The river divides the parish and it was decided to build two plants, one to serve the area on each side of the river. Financing and other costs differed so greatly in the two districts that it seemed wise to separate the responsibility and permit each area to administer its own system. However, the two plants are similar; the following description covers the plant on the eastern bank of the river. Plant capacity is 1.5 mgd.

Organization of the districts began five years ago. Barnard and Burke, Consulting Engineers of Baton Rouge, designed the plant which was completed in 1952. Since the installation was an entirely new one, there was nothing to limit the freedom of the design engineer; consequently the installation is a show place.

An attractive two-story brick building, situated approximately one hundred yards from the levee, houses the principal equipment and provides a business office for the district. The lower level contains three service pumps, a fire pump, the backwash pumps, and the control equipment required, while the second floor provides access to the filters and the Accelator treatment unit which is in the uncovered portion of the building. Space for the required laboratory instruments as well as for the chemical feeders, and storage, is also provided on the second floor. Treatment is provided by an Infilco Accelator system. All of the pumps used are single stage, Fairbanks-Morse centrifugal pumps, driven by Fairbanks-Morse electric motors.

● **THIS attractive building houses the pump station, treatment plant and district business office. At top of page is view of Infilco Accelator settling tank.**

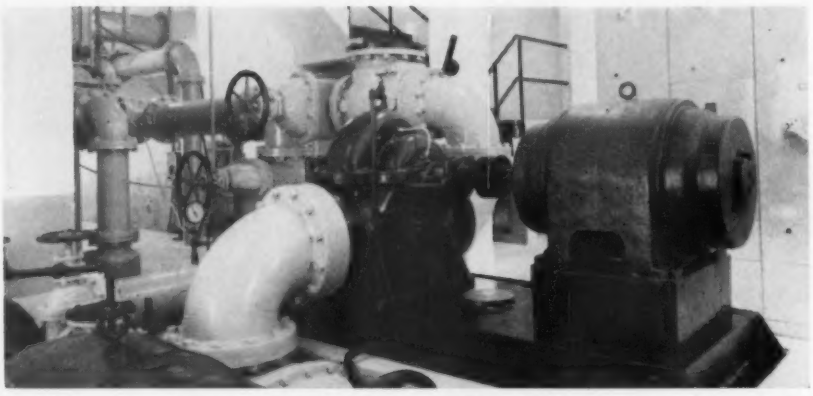
At New Sarpy, La., where the plant is located, the Mississippi River rises and falls as much as 18 feet from flood-stage to below-normal flow. Taking suction from the river could have been difficult, but the two river water pumps were placed on a specially fabricated steel barge which is connected to the plant intake line through an articulated elbow. Operation of the river water pumps is controlled remotely from a station located in the main pump room. Two side-suction pumps, 50 ft. TDH, with their drive motors are located beneath hatches on the barge. One of these is a 4-inch, 700 gpm, F-M pump while the second pump is a 5-inch, rated at 1000 gpm. These two pumps operating at capacity for 24 hours could provide about 2.5 mgd, comfortably in excess of the planned plant maximum output of 1,500,000 gallons per day. At present the system demands are met with a daily 8-hour shift.

Water from the river pumps flows along an elevated pier, level with the top of the levee, and thence underground to the plant. Total water flow to the plant is metered with an orifice meter just before the water enters the treating tank.

Automatic chemical feeders supply the proper quantities of iron sulphate and lime to the treatment tank and the concentrators deliver the floc to a sump for return to the river. Two vertical, wet-pit, suspended, 1½-inch, Fairbanks-Morse pumps provide pumping service for the sludge return. Although the pumps are identical, the driving motor for one is 3 horsepower while a 2 horsepower motor is provided on the other. The larger motor permits a flow of 100 gpm against a 60 ft. head and the same size pump with the smaller motor handles 50 gpm at 40 ft.

From the flocculation and settling tank, the water is passed through sand filters and thence to a concrete reservoir at ground level just behind the building. Two filters are

● FLOATING intake provides uniform suction lift for pumps despite river level.



● THIS pump, the largest in the plant, furnishes 2700 gpm for washing filters.

in service but space was provided for a third tank and the additional unit will soon be installed.

Each filter is equipped with a loss-of-head indicator to govern the frequency of the backwash operation. Plant procedure calls for backwashing of the filters when the head loss through the filter is 10 feet. The backwater pump is located at the base of the filters on the ground floor adjacent to the battery of service pumps. It is a 10 inch, F-M centrifugal with a capacity of 2700 gpm at a 50 ft. TDH.

The 100,000 gallon reservoir at the plant is the beginning of the distribution system to the 142-ft. towers at Norco and Destran which also have 100,000 gallons capacity. There are three F-M pumps delivering to the distribution system; two are 700 gpm, the other 350 gpm. In addition to the service pumps, a larger emergency fire pump is available for service when electrical power fails or when system demands suddenly increase. This is a dual-drive pump which can be powered by either a 75-horsepower electric motor or a six-cylinder natural gas or butane engine. The 4-inch pump delivers 750 gpm at 241 ft. head (46 ft. greater than the 195 ft. head for the service pumps). The drive shaft extends through both ends of the casing with the motor on one end and the clutch-connected engine on the other.

The operator controls all pump operation from a Westinghouse motor control center in the main pump room. When conditions require the operation of the engine-driven pump, the operator need take only a few steps to the engine starting station, where a twelve-volt storage battery system permits push-button starting. In order to keep the gas engine in good mechanical condition, it is used to supply the power each Sunday for at least part of the day.

This plant was built to meet a future and growing demand; the volume of water now pumped is naturally far below plant capacity. In this situation, operating costs per 1,000 gallons are usually high. By operating at full capacity for one 8-hour shift a day, good efficiency and low unit cost have been attained. The reservoirs are full at the end of the pumping day and supply ample water through the 16-hour period when the pumps are idle. This one-shift operation not only provides efficient loads for the equipment but makes it possible to keep labor costs at a minimum.

A basic monthly charge of $2.30 is made for consumption up to 5000 gallons with an additional charge of 30¢ a thousand to 10,000 gallons and 20¢ for consumption in excess of the latter amount. There are 168 fire hydrants serviced by the new system without charges of any sort. A fire department with modern equipment stands ready for emergency in a building on the waterworks grounds.

STREET SIGNS USED ON COUNTY ROADS

JENNIE A. RUSS

THE County Planning Commission of La Porte County, Indiana, which was formed a little over two years ago, has completed its first major project, that of naming and numbering all roads in the county and placing signs along them. Now persons asking directions are no longer told that "Farmer Jones' farm is two or three miles up this road. Then you turn right on the black top and his house is the fourth or maybe the fifth on the left. You can't miss it."

All La Porte County roads now have markers at all intersections. Roads that have well-known names keep them. Usually they are winding roads and it would be difficult to number them under the system that has just been established. Straight roads are numbered. Numbers on east-west roads start at a north-south base line and increase 100 every mile east or west. That is, numbers will run 100 E, 200 E, and so on up to 1100 E, and 100 W, 200 W to 1200 W. North and South roads are numbered in the same manner and run to 1000 north and 2400 south. The signs are of metal, painted white, with black letters or numbers, and a small black border. They are mounted on ten-foot metal posts set in cement.

● ROAD numbering method in La Porte County, Ind., is simple and effective.

APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Schneider and Rogus Head New Refuse Collection and Disposal Committees

Warren A. Coolidge, President of the Association and Director of Public Works for Nashville, Tenn., has announced the appointment of two important Committees. The first is a Committee on Refuse Collection Practice which will prepare a revised edition of the Association's 659 page book on this subject which was originally published in 1941. Warren A. Schneider, Director, Bureau of Sanitation, Department of Public Works, Los Angeles, Calif., is chairman of this committee. Other members of the committee are: Ralph C. Taylor, Superintendent of Waste Collection, Cincinnati; Theodore C. Eppig, Superintendent, Bureau of Sanitation, Chicago; Henry L. Giles, Sanitary Engineer, Department of Public Works, Hartford, Conn.; William A. Trezona, Superintendent of Refuse Collection, Spokane, Washington; Stanley I. Pinel, Management Engineer, New York City; and Dale N. Garst, Director, Refuse Department, Wichita.

A new book on Refuse Disposal Practice will be prepared as a concurrent project by a second Committee which is headed by Casimir A. Rogus, Director of Engineering, Department of Sanitation, New York City. Other members of this Committee are: Theodore E. Winkler, Engineer of Waste Disposal, Department of Public Works, Detroit, Mich.; William A. Xanten, Superintendent, Division of Sanitation, Washington, D. C.; Professor John Snell, Chairman, Department of Civil Engineering, Michigan State College, East Lansing, Mich.; Jean L. Vincenz, Director of Public Works, San Diego County, Calif.; Carl Schneider, Consulting Engineer, New Orleans, La.; and John A. Bailey, Commissioner of Sanitation, Philadelphia, Pennsylvania.

Arrangements have been made in cooperation with the U. S. Public Health Service, for Leo Weaver, Senior Assistant Sanitary Engineer of their Division of Sanitation to serve as Secretary of these committees.

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Seven Chapters Report on Meetings

The Rackham Educational Memorial Building in Detroit was the site of the 1955 Michigan Public Works Conference which was sponsored by the **Michigan Chapter** of the APWA in cooperation with University of Michigan Extension Service and the Wayne University Department of Civil Engineering. Over eighty members and guests attended this Conference which was held on March 24. George E. Hubbell, Consulting Engineer of Detroit, discussed the topic "Drainage Facilities for the Suburban Community." This was followed by a presentation of a new film on Low Cost Residential Pavements by T. M. Reynolds, Field Engineer for the Portland Cement Association, and an informative talk on the other of the "Big 2" road paving materials by Glenn P. Manz, Assistant Executive Secretary of the Michigan Asphalt Paving Association.

C. F. VanBlankensteyn, Coordinator of Civil Defense for the State of Michigan, gave a very interesting talk at the noon luncheon. The afternoon session began with a discussion of Modern Applications of Soil Mechanics by Olaf Stokstad, Engineer of Soils, for the Michigan State Highway Department. This was followed by a talk with color slides on "The People and Problems of Indonesia" by Professor Ernest Boyce, Chairman of the Civil Engineering Department of the University of Michigan. Edward S. Piggins, Police Commissioner for the City of Detroit, was the featured speaker at the dinner meeting which followed a Social Hour sponsored by the Michigan Concrete Pipe Association.

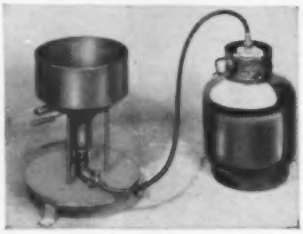
The annual winter meeting of the **Chicago Metropolitan Chapter** was held at the Lake Shore Club in Chicago, March 9, 1955. Over 130 public works officials were present at the luncheon meeting which featured an informative discussion of the water supply and sewage disposal problems in that area by Thomas B. Casey, Chief Engineer of the Division of Waterways of the Illinois Department of Public Works and Buildings.

Kenneth M. King, Traffic Engineer for New Orleans, La., reports that a regular monthly meeting of the **New Orleans Chapter** was held April 5. David R. McGuire, Jr., Chief Administrative Officer for the City of New Orleans, was the guest speaker. His discussion dealt with the operation of the city government under its new charter.

Nearly fifty members and guests of the **Manitoba Chapter** met in Selkirk, March 4. Those in attendance were treated to a tour of the Manitoba Rolling Mills where they watched the manufacture of steel channels and angles from the molt-

Insto-Gas
T M REG U S PAT OFF

JUMBO FURNACE



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Now Insto-Gas offers JUMBO, an instant lighting furnace that will melt large quantities of lead, babbitt, zinc and compounds quickly. Only 15 minutes heating time required for 200 pounds of lead.

The broad base of the JUMBO furnace permits use on uneven or soft ground, and a convenient bail handle makes it easy to move on the job. Cast iron melting pots with pouring lips, tilting lugs and tilting hooks are available in 100 and 200 pound capacity.

When a 50 ft. connecting hose is used the JUMBO furnace can give service over a wide area without moving the cylinder. The flame control valve is located on the furnace.

INSTO-GAS TORCHES

Utility Maintenance departments use Insto-Gas torches for soldering, sweating copper pipe fittings, preheating and thawing.

INSTO-GAS EQUIPMENT IS LISTED BY BOTH UNDERWRITERS LABORATORIES AND FACTORY MUTUALS LABORATORIES

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en stage to the finished product. Mayor Oliver welcomed the chapter to the Town of Selkirk at the dinner meeting. This was followed by the presentation of a short film showing the tunnel method of constructing large sewers. A discussion of this and other methods of constructing sewers was led by Les Wardrop, Consulting Engineer of Winnipeg.

Over 225 members and guests attended the annual dinner of the **Philadelphia Metropolitan Chapter** at the Engineers Club, February 24, 1955. Members of the Philadelphia City Council were special guests at this meeting which featured the presentation of the Chapter's Meritorious Service Medal to John Briggs who has been engaged in

Mr. Briggs receives Meritorious Service Medal from APWA President Coolidge.

public and private engineering practice for over fifty years and to Street Commissioner Henry D. Harral. Warren A. Coolidge, Director of Public Works, Nashville, Tenn., and President of the APWA and Edward P. Decher, Secretary of the Joint Sewer Commission of Newark, New Jersey, and Eastern Area Vice President of the Association were the principal speakers at this event. The March meeting of the Chapter was also held at the Engineers Club. Personnel problems were discussed at this session by Donald C. Wagner, Personnel Director for the City of Philadelphia and R. C. Winchester and B. B. Palmer who are the Personnel Officers for the Street and Water Departments respectively.

Members of the **Minnesota Chapter** met in Minneapolis, March 28-30, to attend the annual City En-

Mr. Harral, left, and Mr. Coolidge.

gineers' School which is sponsored by the Center for Continuation Study of the University of Minnesota. James Rough, City Engineer of Hibbing and President of the Chapter, presided at the meeting. Highlights of the meeting included a discussion of New Legislation by Orville C. Peterson, Attorney for the Minnesota League of Municipalities; a speech on Public Relations and "Tips on Talking" by Edward A. Zakraishek, Counsellor for the St. Paul Committee on Industrial Relations; a discussion of Special Assessment Problems by C. C. Ludwig, Executive Secretary of the Minnesota League of Municipalities, C. A. Armstrong, City Engineer of Rochester, Everett Enns, City Engineer of Willmar, and Clayton LeFever, Village Attorney of Richfield. Robert D. Bugher, Assistant Director of the American Public Works Association, presented a paper and led a discussion on "How to Organize A Public Works Department." Frank Zeidler, Mayor of Milwaukee, Wisc., was the featured speaker at the dinner meeting. His talk, "The Future of Cities" was especially interesting since it dealt with a wide variety of municipal problems which have developed as a result of the rapid growth of the automotive industry.

Other subjects discussed at this School were: "Pitfalls in Purchasing," by William Steven, Assistant Director of Purchases for the State of Minnesota; "Urban Traffic Surveys," by Paul Staffeld, Planning Research Engineer for the State Highway Department; "Testing and Inspection of Street Paving," by Charles Britzius, Research Director, Twin City Testing and Engineering Laboratories, St. Paul; "Equipment Maintenance and Equipment Records," by Hamilton Lufkin, Mechanical Engineer for the State Highway Department, and "Drainage in Relation to Highway Improvements," by Marvin E. Herman-

(*Please turn to page* 117)

ASH or CA$H?

from your SEWAGE DISPOSAL PLANT

The new sewage disposal plant in Wyomissing Valley, Pennsylvania (Albright and Friel, Philadelphia, consultants), could have been designed for incineration. But it wasn't. Here's why.

It was known that the sludge would be free from contaminants. By flash drying and selling this sludge, the plant could perform a service to the community and to itself. Dried sludge is rich in humus, is easy to handle and contains the elements found in good topsoil. After being dried, an excellent organic soil conditioner could be made available to the public at a reasonable price. At the same time, the expenses of incineration – ash handling and disposal, for example – would be avoided while the revenue from the sale of dried sludge would help offset operating expense.

Naturally Wyomissing Valley chose cash not ash. And, since the plant is located within a few hundred feet of a new apartment development a C-E high temperature deodorization system is incorporated in the design to guarantee odor-free operation.

Actual operation of this plant has confirmed the wisdom of the decision made in Wyomissing.

In communities where the character of the sludge makes it unsuitable for use as a soil conditioner, incineration may be the only answer. But, whether you plan to incinerate or dry, the C-E Raymond Flash Drying System can be designed to allow you to do either at will. Like the communities listed at the right, you too can end your sludge disposal problems effectively and at less cost with the service-proved C-E Raymond System. For full information, contact the C-E Raymond office nearest you. A C-E specialist will be glad to help you.

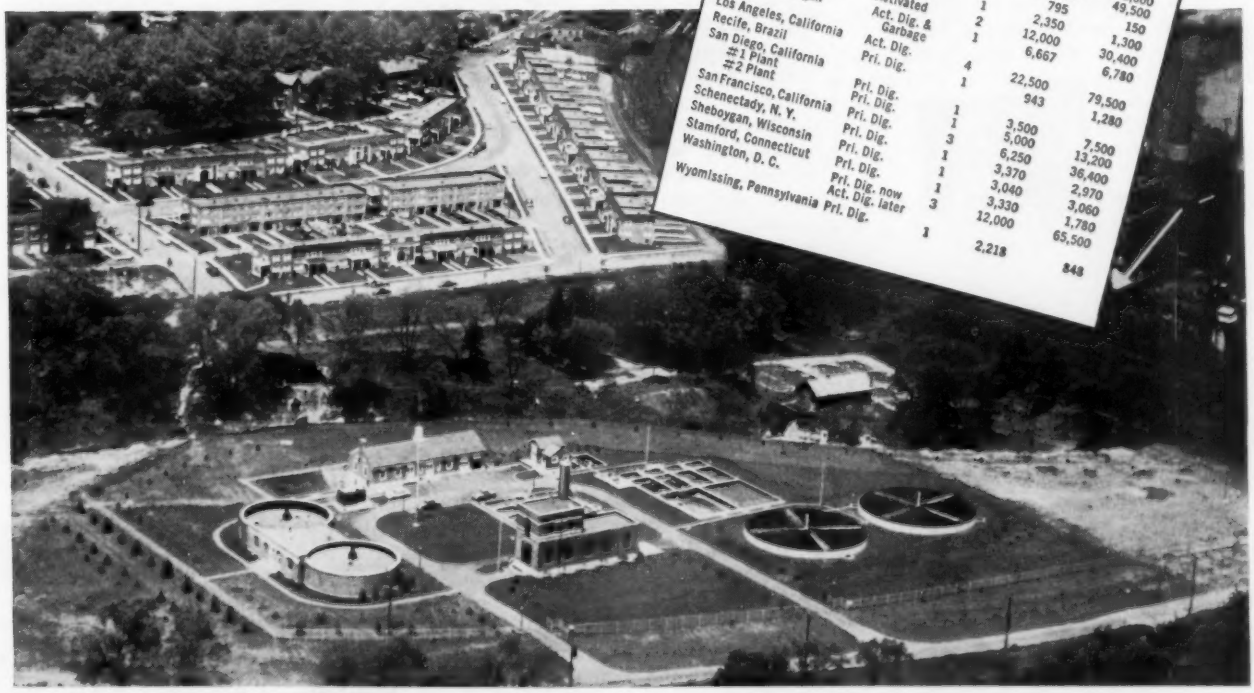
B-810

Wyomissing Valley picked CA$H

C·E

C-E RAYMOND FLASH DRYING SYSTEMS PRODUCING FERTILIZER

CITY	TREATMENT	NO. UNITS	SIZE OF UNITS Lb. Water per Hour per Unit	INSTALLED CAPACITY Tons Fertilizer Per Year
Baltimore, Maryland	Act. Dig.	3		29,800
Battle Creek, Michigan	Pri. Dig.	1	6,140	2,550
Chicago, Illinois			2,370	
Calumet	Activated	3		
Southwest	Activated	8	6,687	
Southwest Ext.	Activated	6	21,000	15,850
Edgewater, New Jersey	Pri. Dig.	1	21,000	148,500
Fond Du Lac, Wisconsin	Pri. Dig.	1	795	49,500
Houston, Texas	Activated	2	2,350	150
Lansing, Michigan	Act. Dig. & Garbage	1	12,000	1,300
Los Angeles, California	Act. Dig.		6,667	30,400
Recife, Brazil	Pri. Dig.	4		6,780
San Diego, California		1	22,500	
#1 Plant	Pri. Dig.		943	79,500
#2 Plant	Pri. Dig.	1		1,280
San Francisco, California	Pri. Dig.	1	3,500	
Schenectady, N. Y.	Pri. Dig.	3	5,000	7,500
Sheboygan, Wisconsin	Pri. Dig.	1	6,250	13,200
Stamford, Connecticut	Pri. Dig.	1	3,370	36,400
Washington, D. C.	Pri. Dig. now	1	3,040	2,970
	Act. Dig. later	3	3,330	3,060
Wyomissing, Pennsylvania	Pri. Dig.		12,000	1,780
		1		65,500
			2,218	
				848



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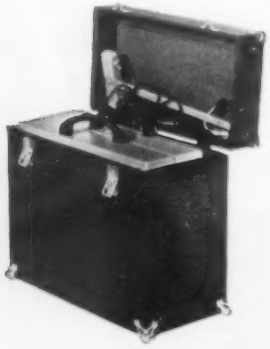

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Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association.

ADMINISTRATION MOVES TO AVERT COPPER SHORTAGE—In late February the Office of Defense Mobilization authorized the sale to industry of approximately 8,000 tons of copper owned by or under contract to the Government. The action followed appeals by the copper industry which was beginning to feel a pinch. Some municipalities had experienced delays on copper orders. In addition the Secretary of Commerce was ordered to cancel deliveries for March under the Defense Production Act, in order to divert the copper to U. S. industry for fabrication into civilian products. The second quarter, 1955, set-aside for copper was also reduced by 18 million pounds.

POSSIBLE HUGE NEW SHELTER PROGRAM FORESEEN — Washington observers foresee the possibility of a huge shelter-building program, as a result of recent disclosures on the deadly effects of radioactive fall-out. Civil Defense officials admit being caught with their shelters down. The Senate Armed Services Committee, sub-committee on Civil Defense, headed by Senator Kefauver, has been holding extensive hearings on the CD problem. Federal Civil Defense Administrator Val Peterson has admitted that the fall-out problem "makes some kind of a shelter program a necessity." Up to now there has been no federal shelter program and no federal matching funds available for such construction. Envisioned by some CD experts is a ring of shelters surrounding every target city, as well as huge shelters in the non-target areas to which urban populations would be evacuated. Milwaukee Mayor Frank P. Zeidler, told the Senate sub-committee that "the new factor of radioactivity makes the thought of shelter construction very important. If we are to believe the opinion of experts that within six to ten years there will be intercontinental rockets armed with atomic war heads, even the factor of dispersal will not prove adequate, and there must be substantial construction of shelters." Key Legislative and Executive officials are now mapping plans for such a program. It will probably take the form of matching federal grants for cities to build shelters. Observers predict large-scale public works programs to construct thousands of them, possibly getting underway within a year.

ADMINISTRATION HIGHWAY PROGRAM DETOURED — Roadblocks are being thrown in the path of the Administration's "grand plan" for improving the nation's highways. Proposals by the President to up the Government's participation in roadbuilding from the present 13% to 30% of the total for the next 10 years have met with sharp rebuffs in Congress. Senator Byrd says it is a subterfuge to go outside the debt limit and that he will fight the financing proposals. Senator Gore, Chairman of the Senate sub-committee on Roads says it is a "pig in-a-poke," and that he thinks it is "so full of holes that it will sink in committee." He has proposed his own bill, S-1048 which would provide an appropriation of approximately $1.6 billion per year in place of the present $875 million. The interstate system, under his proposal, would get the biggest increase and funds for this system would be put up, likely, on a 2-1 basis. Here's a comparison of the Gore proposal with the present Federal-aid road act:

System	*Present*	*S-1048*
Primary	**$315 million**	**$500 million**
Secondary	**210 million**	**325 million**
Urban	**175 million**	**275 million**
Interstate	**175 million**	**500 million**

The heart of the President's proposal is a $25 billion federal expenditure on the interstate system, financed by long-term bonds paid off from gas tax revenues. His pro-

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posal would continue expenditures on the systems at the same rates as the 1954 Federal Aid Highway Act. State and local government would put up an additional $2 billion for the interstate system, which is also equal to current expenditures. Of the $27 billion to be spent on the interstate system, about $15 billion would go to urban areas, including feeder streets, arterials and expressways. Mayor Albert E. Cobo, of Detroit, criticized the Gore proposal and said that its rate of expenditure would not bring the interstate system up to needs for 30 years. The President proposes to do it in 10. Chief contention is over financing. Democratic opposition to the plan contends that payment should be made from current revenues. Proponents of the Clay Committee proposals say that highways are a capital asset properly paid for by capitalization because they lend themselves to long-term financing. A "great debate" on highways is predicted for at least another six weeks as the Senate Roads subcommittee puts the show "on the road," with hearings scheduled for nine U. S. cities; Albany; Atlanta; Hagerstown, Maryland; Chicago; Kansas City; Fort Worth; San Francisco; Portland and Denver.

U. S. SUPREME COURT HOLDS CITIES MAY FLUORIDATE WATER—In an important decision affecting the right of a municipality to fluoridate water supplies, the Supreme Court refused to review a decision of the Oklahoma Supreme Court which held that Tulsa had such a right. The city was challenged by opponents of fluoridation who contended that such a practice was a violation of regular religious freedom guaranteed by the First Amendment to the U. S. Constitution. In the case of *Dowell v City of Tulsa*, the U. S. Supreme Court has finally put its approval on municipal ordinances providing for fluoridation and OK's such action as a proper exercise of the police power and that fluoridation does not violate public policy.

• • •

Spraying Longmont Cost $4148

The summer spraying program for insect control in Longmont, Colo., cost $4,148 in 1954 as compared with $5,225 the preceding year. Less costly spray was used. However, 1,100 gallons were used for each complete coverage—about 200 more than the preceding year as a result of growth in the city's area.

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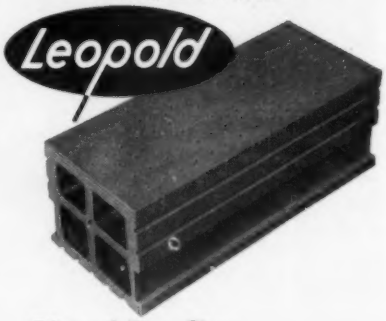

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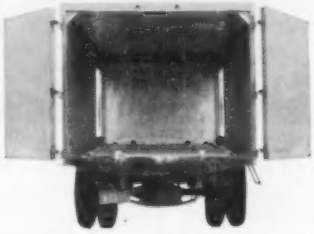

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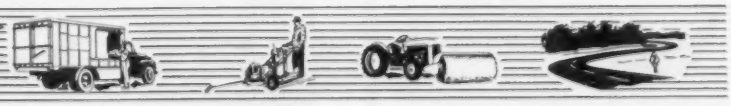

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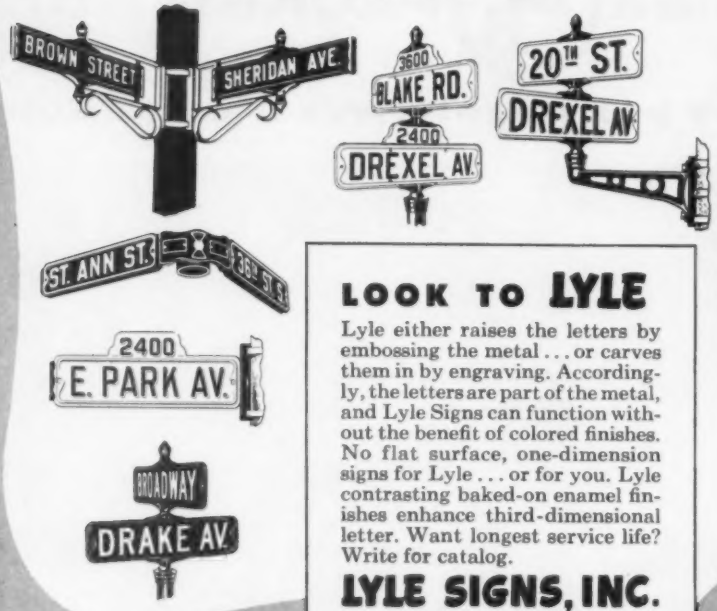

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Clean Air for CALIFORNIA:

Approaches to Engineering Remedies

EXISTING information on the nature, sources and extent of air pollution in California has been summarized by the Department of Health of that state. The report, addressed to the Governor of California, has been published in an attractive and useful booklet of 60 pages. The chapter on "Approaches to Engineering Remedies" is reproduced herewith:

The solution of California's air pollution problems will depend on the successful application of engineering principles. It therefore seems desirable to evaluate possible engineering remedies.

Th principles which will be considered are as follows: (1) Control of air pollution emissions at the source; (2) substitution of materials and methods; (3) zoning; (4) improving ventilation of communities; (5) neutralizing the pollutants in the atmosphere; (6) governing emissions according to meteorologic conditions.

Control of air pollution emissions at the source—Air pollution control programs have placed major emphasis upon the control of emissions at the sources, such as metal, mineral, and paint manufacturing, varnish cooking and metal plating industries and many others. Reduction has been accomplished by equipment which removes dust, fumes and gases at the stack or other discharge points. To reduce emission of gasoline and other petroleum vapors, modification of storage tanks to prevent escape of vapor have been introduced and vapor recovery systems installed. No generally accepted method for control of automotive exhaust is presently available.

The automotive industry is working on the problem and is developing a device which may curtail the loss of hydrocarbons from exhaust as much as 30 to 50 percent. However, the Los Angeles County Air Pollution Control Officer has called for a reduction of 90 percent in hydrocarbon emission from automotive exhaust.

Two general approaches to the problem are now being studied: The inclusion of catalytic and flame type afterburners; and redesigning the engine for more efficient combustion. Of the two methods, design of in-

ternal combustion engines for more efficient fuel use appears more advantageous to the automotive users.

Substitution of materials and methods—Substitution, a principle used successfully in industrial hygiene for many years, may apply to air pollution control. Some examples are:

1. Reduction in automobile travel would reduce the quantity of automotive emissions. Substitutions of adequate mass transit for a portion of automobile travel would be desirable in California's metropolitan areas. In Los Angeles County a study has been made, limited to a monorail rapid transit line.

2. The elimination of backyard incineration will require the substitution of some other means of waste disposal, such as the use of sanitary land fills, combustion in efficient municipal incinerators, or composting methods for certain types of wastes.

3. Use of alternate fuels instead of gasoline may prove to be a way to reduce automotive emissions. Certain substitute fuels such as liquefied petroleum gases have been used in internal combustion engines. Substitution of fuels is usually not practicable on a large scale because of their short supply.

Zoning—In locating new industrial plants, consideration should be given to the geographic and the prevailing meteorologic conditions to prevent unnecessary pollution of residential areas. Industries which discharge pollutants should locate so that their emissions normally drift away from populated sections of the community. Los Angeles County has taken a step in this direction by the appointment of a representative of the County Regional Planning Commission to make zoning recommendations based on the findings and advice of the Los Angeles County Air Pollution Control District. Zoning may be applied in another sense to delineate geographic areas within which total emissions of certain pollutants to the atmosphere are not permitted to rise above a fixed value. Since zoning of air pollution sources is primarily preventive in nature, it may prove especially helpful in the metropolitan areas of the State not yet severely affected by air pollution.

Improving ventilation of communities—Better ventilation of California's coastal cities theoretically might assist in the dispersion of pollutants. The Los Angeles area has been depicted as a basin with the temperature inversion as the lid

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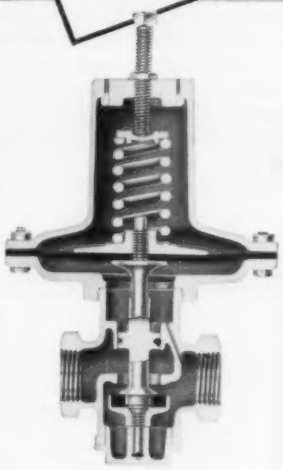

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and the mountains and prevailing onshore breezes as the sides. Theoretically, better ventilation might be obtained by dissipating the inversion or by providing openings in the mountains.

Three approaches to dissipating the inversion have been considered: (1) thermal; (2) mechanical; and (3) catalytic. A rough computation was made of energy requirements to dissipate an inversion thermally (heat). The energy requirements were found to be more than the available electric energy in Los Angeles County. Pumping or blowing air through the inversion layer (mechanical dissipating) is a gigantic task and at this time would seem to be impracticable. Catalytic dissipation of the inversion using water vapor as the vehicle for rapid energy transfer between the surface air and the inversion air is an approach which has also been considered, but which cannot be evaluated in its present state of development.

Rough computations have indicated the magnitude of the task of ventilating the Los Angeles County Basin by creating openings in the mountains. They show a minimum requirement of some 14,000 ventilation tunnels, each approximately 40 feet in diameter. This principle, therefore, while appealing strongly to the layman does not appear to be practicable when applied to a large metropolitan area.

Neutralizing the pollutants in the atmosphere—The addition or release of certain reactive or opposite acting compounds in the air might create a balance whereby the objectionable air pollution would be neutralized. This might reduce the adverse effects of air pollution even though the total atmospheric loadings were high.

The drawbacks to this appear to indicate that this principle cannot be recommended for use in the light of present knowledge, but it should receive study for possible future application.

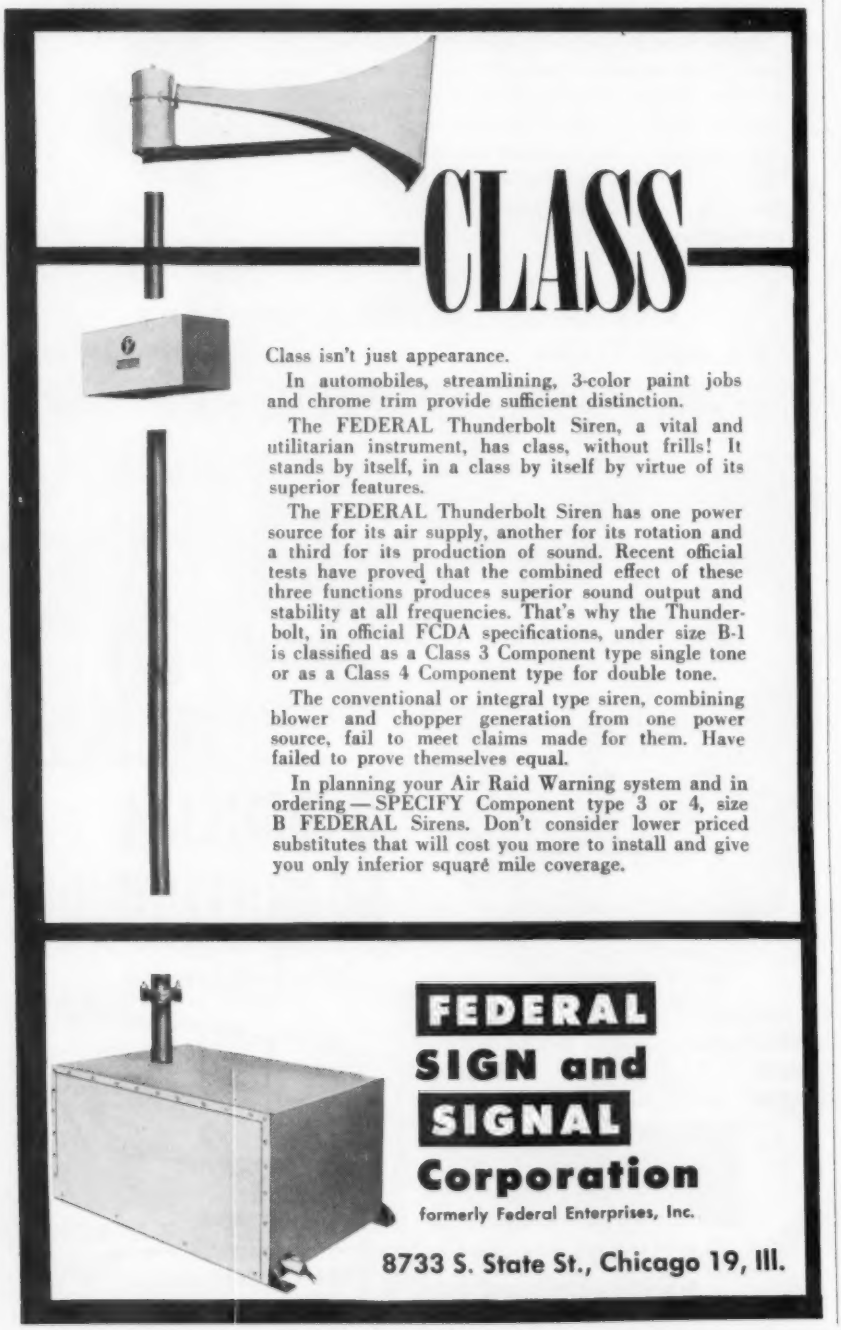
Governing emissions according to meteorologic conditions—The discharge of emissions into the atmosphere during periods when the meteorologic factors are such as to provide ideal mixing and diluting is a method of control that has been used successfully for many years. The best publicized industrial operation using this principle is in Trail, British Columbia, where huge storage tanks are utilized to retain the pollutants during unfavorable meteorologic conditions and to release them during more favorable conditions. The applicability of this control method to California's problems should receive careful study and consideration.

Citizen interest in possible engineering remedies is high. During the severe smog episodes last fall over 250 citizens sent letters, postcards and telegrams to the Governor and most of these concerned possible engineering remedies. One interesting and potentially helpful suggestion was for a particular type of photographic survey of smog formation which has apparently not yet been made. So that meritorious ideas will not be overlooked, some agency should be designated to take a continuing interest in suggestions which may come from all sources, including private citizens.

• • •

County Recreation Body is Organized

The City of Sterling, Logan County, Colo., and the school districts therein will share jointly in financing a $10,000 countywide recreation program that will get underway with appointment of a full-time director in 1955.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Sewage Works Development in Connecticut

Moosup, Rockville and Stafford Springs have engaged consulting engineers to prepare plans for treatment works. Willimantic has employed engineers to review its plans and expects construction of the treatment plant to start in 1955. Westport and West Haven have appropriated funds for revision of their plans for sewage treatment plants. New Haven has submitted plans for its sewage treatment plant to the State for approval. Branford and Windsor Locks have had plans prepared for sewage treatment plants. Both communities are now considering the acquisition of sites for their proposed treatment plants.

Danielson, Jewett City and the Pawcatuck Fire Districts were given hearings by the State Water Commission to show cause for not proceeding with their programs of pollution abatement.

• • •

American Public Works Association

(*Continued from page* 108)

son, Hydraulic Engineer of the State Highway Department.

The Northern California Chapter held a joint meeting with the East Bay Engineers Club at the Athens Club in Oakland, February 25. Professor Lester E. Reukema, of the Electrical Engineering Department of the University of California, gave an interesting talk on industrial applications of atomic energy. The regular monthly meeting of the chapter was held in Stockton on March 4. Marshall Dunlap, City Engineer of the host city introduced the principal speaker who was Theodore Neuman, Supervising Hydraulic Engineer for the State Department of Public Works. He discussed the highlights of the Feather River Project which is twice as large as Shasta Dam and will impound four million acre feet of water. It will be a gravity line from Oroville to Tracy and will include a 10½ mile tunnel in the southern part of California with a 7½ mile siphon across the valley. The total length of the project, he said, is 585 miles. It is estimated to cost $750 million to Wheeler Ridge. Studies indicate that this project will make it possible for water to be supplied to the Fresno area for a cost of about $12 per acre foot. If the water is pumped over the Tehachapi Mountains, it could be delivered to the Los Angeles area for a cost of about $45 per acre foot.

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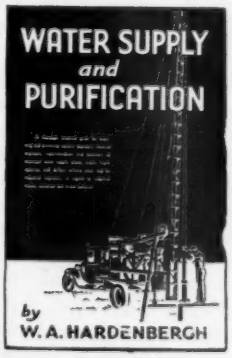

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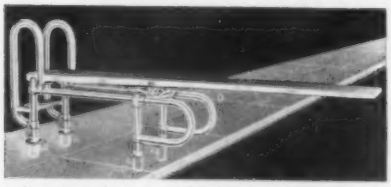

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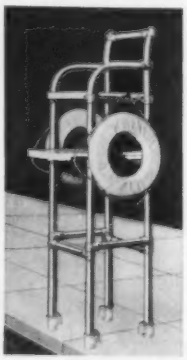

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Water-Borne Aspects of Infectious Hepatitis

C. H. CONNELL, PH.D.
Professor of Sanitation, Department of Preventive Medicine and Public Health, University of Texas Medical Branch, Galveston, Texas

A paper, slightly condensed, which was presented before the American Public Health Association Meeting at Buffalo.

THE over-all sanitation problem of infectious hepatitis is the same as for other diseases spread principally by the fecal-oral route. That is, the fecal contamination of water and food must be kept to a minimum, and this minimum must be removed or neutralized before reaching the body. Recent experimental evidence by Neefe and Stokes and co-workers [1,2] that a high proportion of the populace are potential carriers of the virus and the demonstrated resistance of the virus to environmental changes [3,4] and to disinfection measures [5,6,7], indicate that the prevention of this disease by means of sanitation may be more difficult than most other filth diseases. Futhermore, epidemiologic and sanitation experience indicate that sanitary engineers, and other members of the health team should give high priority to the water - borne aspects of infectious hepatitis in their work.

The areas of vulnerability in most probable order of significance are: (1) Inadequacies in water supply and waste disposal facilities in rural and suburban areas, camps, resorts and institutions; (2) defective design, operation and maintenance of swimming pools and inadequately protected beaches; (3) cross-connection back-siphonage contamination of water supplies in private service distribution systems; (4) breakdowns in safeguarding public water supplies; and (5) inadequate sewage treatment.

Rural, Suburban, Camp, Resort and Institutional Water Supplies Infectious hepatitis epidemics of record, in which water supplies have been incriminated or suspected, have been attributed to cesspool seepage through creviced shale or limestone into rural and camp wells [5,6,8]; drainage of septic tank effluents into streams and lakes from which untreated water was being used [9,10,11]; seepage from a broken sewer into hospital wells[11]; and to surface privy drainage and seepage into a ground cistern supplying troops[12]. These indicate the area of greatest vulnerability.

To reduce this vulnerability it will be necessary to do a better job than has as yet been done in eliminating privies and cesspools; to develop better family, camp and institutional waste disposal facilities; to protect small water supplies; and to extend adequate public water supply and sewer systems into more and more suburban areas.

Swimming Pools and Beaches. Records showing swimming pools and beaches to be important factors in the spread of infectious hepatitis are few[11,13], but the actual number of epidemics originating from non-sanitary pools and unprotected beaches is probably considerable and the sporadic cases quite numerous.

The demonstrated resistance of the infectious hepatitis virus to coagulation, sedimentation, filtration and chlorination[6,7] raises the question of the effectiveness of the water treatment processes used in many swimming pools, even those of modern design and accepted standard operation. The demonstrated long survival of the virus in natural water[5,6] raises a question of the safety of many beaches and natural flow-through pools which normally are considered to be sufficiently removed from significant sources of fecal pollution.

These hazards are sufficiently real to justify increased efforts toward elimination of all public fill-and-draw type swimming pools, reduction in the number of flow-through pools, while requiring effective chlorination of all such pools; discouragement of the construction of private swimming pools. Also desirable are enforcement of high standards for design, construction and operation of re-circulation pools, including reduction of swimming load; raising of standards for swimming beaches, with less emphasis upon coliform density and more on remoteness from sources of fecal contamination, and on better control of swimming loads and more education of the public on essentials of swimming pool and beach sanitation.

Cross-Connections and Back-Siphonage. Records, or even the occurrence, of infectious hepatitis epidemics caused by back-siphon-

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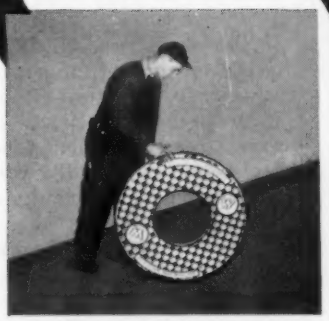

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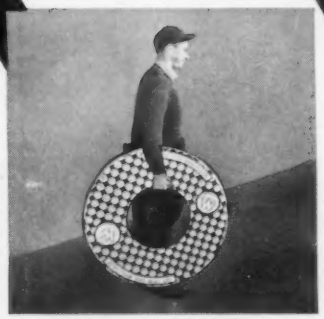

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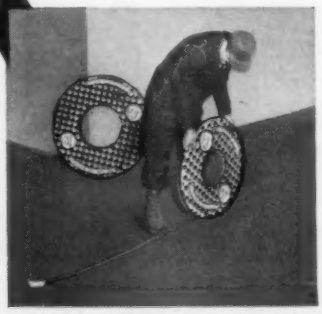

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age from improper plumbing fixtures and inadequate private service water lines probably are not numerous. Following the amebiasis epidemic in Chicago of 1933, great strides were made in plumbing codes and practices and many improvements were realized in water pressure and distribution capacities of public supplies. Progress in this respect has passed the peak and there is evidence of deterioration in protection of water supplies in the areas of final delivery to the consumer.

The recognition that infectious hepatitis is another disease that can be spread in this manner emphasizes the need for a re-evaluation of the adequacy of the standards and practices in the protection of water supplies from the curb to the faucet. Water works departments should bring water to the customer's curb through distribution mains, under proper pressure and containing free residual chlorine. Then connection with private services should be refused unless it is known that standard specifications are met.

Public Water Supplies from the Source to the Meter. It is doubtful that public water supplies will ever carry an infectious concentration of the hepatitis virus unless there is a serious breakdown in sanitation in one or more of the areas of source protection, procurement, transmission, processing, storage and distribution. However, in light of the demonstrated long survival of the virus in water and its comparatively high resistance to treatment processes, there is greater possibility than is the case for the bacterial etiological agents of other water-borne diseases. These potentialities emphasize the need for higher standards and better enforcement of watershed sanitation; more and more effective sewage treatment; and higher over-all proficiency in design, construction, maintenance and operation.

Sewage Collection, Treatment and Utilization. There is little knowledge of the survival of the hepatitis virus in sewage, but until it is demonstrated otherwise it will be necessary to assume that the virus is probably less readily removed or inactivated by conventional sewage treatment processes than are the etiological agents of other fecal filth diseases. And yet it is plausible to assume that the more intensive the treatment the more completely the virus is removed. Therefore, even more effective sewage treatment is indicated whenever the possibility of contamination of swimming and recreation areas or water supply sources is involved; and increased care should be exercised in the expansion of the uses of sewage and sewage sludges for irrigation of crops and for utilization as fertilizer.

Water Treatment and Virus Inactivation

The investigations of Neefe, Stokes, Baty and Reinhold[6, 7] on the inactivation of the virus of infectious hepatitis in drinking water were comprehensive and informative. Working with water containing approximately 50 ppm of added viral contaminated feces the following results were obtained:

Chlorination alone at a dosage of 2.5 ppm producing 1.1 ppm total chlorine residual after 30 minutes failed to inactivate the virus, but a dosage of 25 ppm producing 15 ppm chlorine residual after 30 minutes gave results indicating satisfactory attenuation of the virus.

Coagulation plus 1-hour sedimentation followed by filtration through a diatomaceous earth filter, but with no chlorination, failed to remove the virus.

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Coagulation and sedimentation plus filtration, with chlorination at as low as 3.25 ppm, producing, after 30 minutes, total chlorine residuals of 1.1 to 2.0 ppm, and free residuals of 0.4 ppm, inactivated the virus.

These results give fairly conclusive evidence that the virus is quite resistant to common water treatment processes, but not so resistant that these processes as applied in modern, protected and properly operated water systems would not neutralize moderately heavy contamination. It is suggested that an adequate margin of safety as pertains to treatment of public supplies can be realized through water clarification processes to a turbidity consistently below 1 ppm, accompanied by free residual chlorination to maintain 1 ppm free residual for one hour, and to insure a free residual in the extremes of the system.

For water supplies other than protected and treated public supplies, the first emphasis should be on prevention of entry of fecal pollution by means of selection, location and proper construction, and on bacteriological demonstration of absence of fecal contamination. Then, supplementary protection, through chlorination should be provided.

For rural or field supplies known to be polluted, or for water of questionable quality, chlorination of non-turbid water to a 1-hour free residual in the range of 2 to 4 ppm probably will give satisfactory inactivation of hepatitis virus contamination. But for even slightly turbid water higher and/or longer free residuals would be indicated. Very turbid waters should be clarified and subjected to heavy free residual chlorination.

In the field of water and sewage purification the following research investigations are needed:

1. There should be a comprehensive extension of the work of Neefe, Baty, Stokes and Reinhold on the effectiveness of water treatment processes in the removal and inactivation of the virus, including: (a) Measurement of the effectiveness of coagulation, sedimentation, filtration and chlorination under conditions approximating those of plant scale operation; (b) a more precise evaluation of the effects of chlorine, particularly when free available chlorine alone is present; and (c) an evaluation of the effect of pH upon the effectiveness of coagulation, sedimentation, filtration and chlorination.

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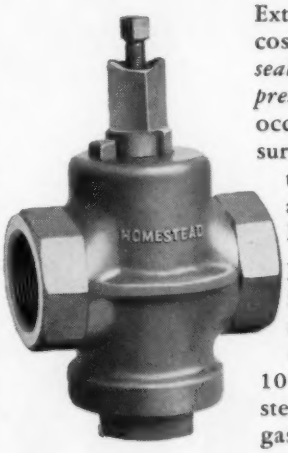

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should be made of the effectiveness of sewage treatment processes in removal or attenuation of the hepatitis virus.

3. An evaluation should be made of the bacteriological coliform test as an index of fecal contamination in relation to the presence or absence of the hepatitis virus in water.

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Warren Water

(*Continued from page* 98)

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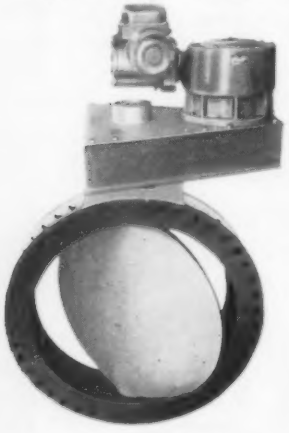

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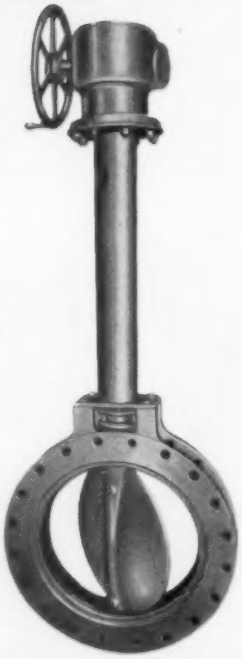

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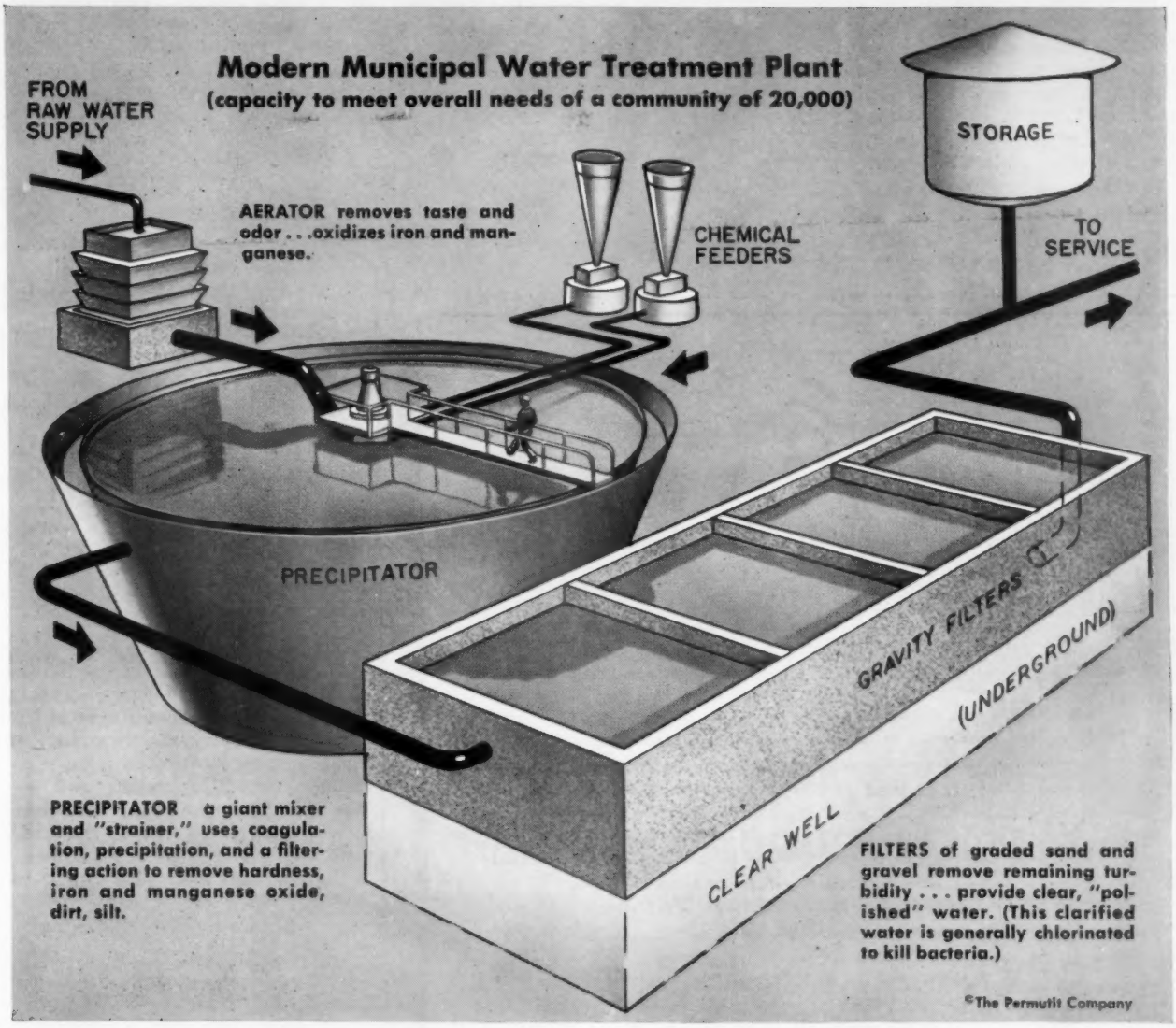
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A service building, 138 x 45 ft. has been built in the city beside the elevated tank. It is unique in that it includes the new council chamber, along with a garage, machine shop, meter shop, and some of the fire department's radio installation. It was built by the W. B. Wilson Company, of Warren, at a contract price of $252,441.

The entire improvement program was designed by Havens and Emerson of Cleveland and New York City. Arthur F. Sidells, architect, was associated with the engineers on the design of buildings. Howard G. Brown, of Warren, was resident engineer. The total cost was $5,450,000, financed by water revenue bonds.

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Periodicity of Dosing of Filters

During experiments at Minworth, Birmingham, England, to learn the relative effects of different periods of dosing, the effects on the macrofauna and on the accumulation of film were studied. Four filters were supplied at the rate of 150 gal. of settled sewage per day per cu. yd. of filtering medium; on two filters the mechanically driven distributor made one revolution in 42 minutes to 55 minutes; on the other two filters the self-propelled distributors varied from one revolution in one minute to one in five minutes. The difference in periods of dosing had a marked effect on the accumulation of film and on the grazing fauna. While the filters with self-propelled distributors developed a thick fungal growth during the colder months and supported a large fly population, those with mechanical distributors contained only a small amount of film, which remained constant during the year, and maintained a very small fly population, and filamentous algae covered the surface. The reduction of film in the filters with longer dosing intervals may be attributed partly to starvation and partly to greater scouring action. Data are presented of the effects upon each of several varieties of macrofauna. It was decided that increasing the period between doses has a beneficial effect on the conditions of filters, including the fly nuisance; and, up to a certain time, on the purification efficiency.

"Periodicity of Dosing." By H. A. Hawkes. *Contractors Record* (England), March 2. *The Surveyor*, Feb. 12. *Municipal Engineering*, Feb. 18.

Unusual Methods Of Dewatering Sludge

In a paper before the Institute of Sewage Purification, England, Dr. Peter Coackley referred to trials of unusual methods in sewage treatment. One of these, speeding the drying of sludge on drying beds by electro-osmosis, would not eliminate necessity for digestion and drying beds, and the reduction in drying time obtained would not be worth the cost of energy required. Ultrasonic treatment of activated sludge caused the sludge particles to settle more readily for a few minutes, but further irradiation tended to destroy the flocs and delay further settling; also sludge containing more than 0.9 percent solids was not affected. Aerobic digestion was considered impracticable because of the longer time required.

"The Dewatering of Sewage Sludge". *Contractors Record*, Feb. 16.

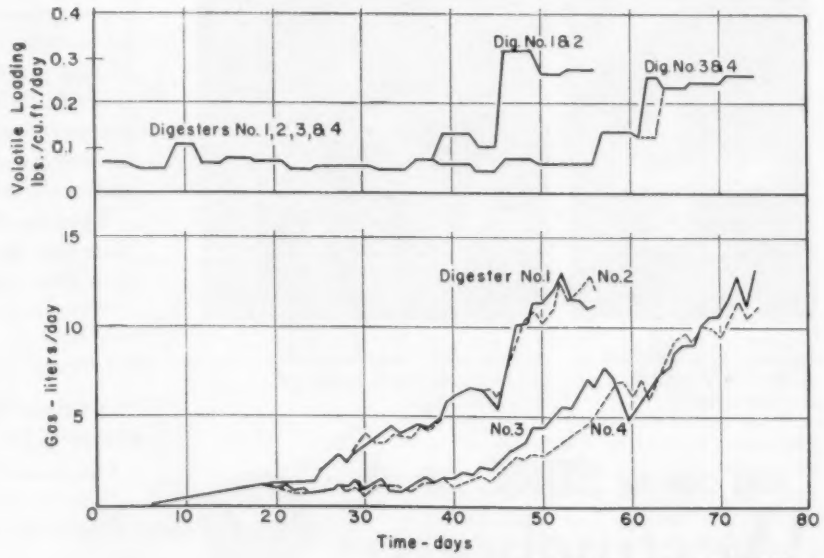
Liming Of Digesters

The effectiveness of liming in starting digestion without seed sludge was studied at the Iowa City sewage treatment plant in 1953. To two digesters lime was added daily with the raw sludge to maintain the pH of the digester contents above 6.5 at all times, until it remained there without lime. Two other digesters were operated without lime. The loading to all four digesters up to the 38th day was identical, the gas production that day in the limed digester exceeded that of the others by three times; but at the end of 75 days all four were digesting normally. Lime was added at a rate equivalent to about 14 lb. of lime per 1,000 cu. ft. of digester capacity per day.

"Scientific Basis for Liming of Digesters". By Peter J. Neuspiel and Philip F. Morgan, State University of Iowa. *Sewage and Industrial Wastes*, February.

Evaluation of Sewage Odors

In estimating odors, obtaining the ratings of a number of observers is considered desirable; they are likely to be similar, with only an occasional dissent from a single individual. In obtaining odor estimations, the observer should not be exposed to the odor prior to making the rating; the gas should be at ambient temperature; exposure to the odor should not exceed one or two seconds; there should be sufficient gas to fill both nostrils, and it should not be blown rapidly against



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the olfactory surfaces. The Los Angeles Bureau of Standards has developed a method for meeting these conditions. Polyethylene bags 10 x 10 x 30 ins. are filled with the gas to be evaluated, using a hand-operated blower where necessary. The bag, when filled, can be carried any distance, and a small amount of gas expelled for each observer. The gas in the bag can be diluted to any desired degree by expelling a definite volume of gas and replacing it with fresh air; the diluted gas can thus be compared instantly with that from an undiluted bag.

"Evaluation of Odors." By C. W. Beardsley and N. J. Krotinger, Bureau of Standards. *Sewage and Industrial Wastes,* February.

Underground Pumping Stations

Topeka, Kansas, in connection with a $3,000,000 expansion of its sewerage system, has installed several underground sewage pumping stations, bringing the total of such stations to 11. These are highly compact, fully automatic units, furnished complete ready to be lowered into place, in a watertight steel tank, with an entrance tube at the top. Two operators take care of all of them. Each station contains two 4-in. non-clog sewage pumps able to deliver 500 gpm at a head of 35 ft. The 7½ hp motors are started and stopped by air purge type controllers activated by the sewage level in the wet wall. Alternate operation is effected by an automatic sequence changer.

"Modernizing a Sewage Pumping System." By D. B. Kissinger, Engr.-Supt. *Water & Sewage Works,* March.

Practicability of Municipal Composting

From a review of all available reports and literature, the author has concluded that, although compost has been produced on a large scale by an open air process in 2 to 3 weeks, this has been demonstrated to be possible only in one area—San Francisco Bay. Only two digester-type pilot plants have been proven to be an operational success. Financial success of any form of composting is doubtful.

"A Critical Evaluation of the Status of Municipal Composting". By Linvil G. Rich, Asst. Prof. of San Eng., Virginia Polytechnic Inst. *Public Works,* April.

Ordinances For Waste Control

A meeting of industrial, municipal and engineering officials from four states, meeting in January as a "Sanitary Engineering Workshop", endeavored to find a common ground for the solution of mutual problems, especially ground rules for developing industrial waste control ordinances. It was agreed that each individual waste ordinance must be made to satisfy local conditions; and that fewer mistakes will be made if, in each city, municipal officials and industrial experts get together and come to a common ground for writing an ordinance to control the discharge of wastes, and set reasonable standards for payment by industries for handling their wastes.

"Second Sanitary Engineering Workshop." *Public Works,* April.

Discussions of High-Rate Digestion

Twenty-seven pages of the February issue of Sewage and Industrial Wastes were devoted to a paper by Wilbur N. Torpey, Engineer of Treatment of New York City's Bureau of Sewage Disposal Operation, and discussions of it by Harry E. Schlenz, President of Pa-

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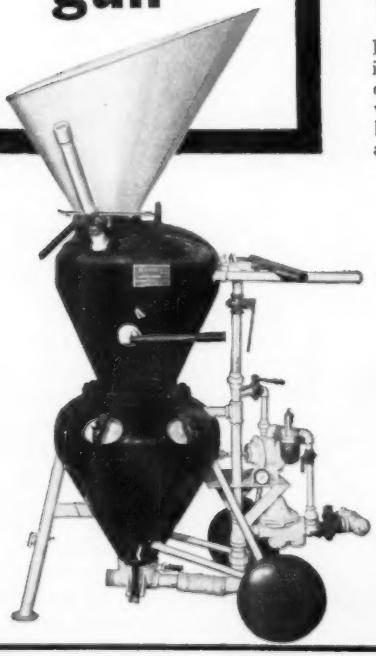

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cific Flush Tank Co.; by H. Heukelekian, Dept. of Sanitation of Rutgers Univ., and Henry R. King, Sr. Civil Engr., Sanitary Dist. of Chicago. Mr. Torpey referred to a previously described plant at Bowery Bay which operated a digestion tank which provided 0.5 cu. ft. per capita. To determine the highest rate at which it was possible to digest satisfactorily, a pilot plant was operated at rates increased periodically until it showed signs of failing. The pilot was provided with a mechanical stirrer and internal hot water coils. Thickened combined primary and activated sludge was applied at 2-hr. intervals seven days a week for more than seven months, beginning June 17, 1953. At first, the pilot and the plant tank received the same loadings, but the former was much more efficient as measured by gas production per day; probably due largely to the stirring, which prevented accumulation of silt in the pilot, while about one third of the plant tank was occupied by silt and a heavy gelatinous digested sludge and floating material. From various data collected during this test the author concluded that, for a mixture of thickened primary and activated sludge, 5 days of detention with complete tank utilization would appear to be desirable, equivalent to a digester capacity of about 0.2 cu. ft. per capita; or 0.4 cu. ft. to obtain practically all the available gas.

Mr. Schlenz, discussing the test data at length, believed that, if better operational control is obtained at sewage plants, digester capacities could be reduced below 0.2 cu. ft.; but that further reduction probably was impracticable because of other important design factor, and to allow for many day-by-day operational problems and imponderables in sewage character and digestion phenomena.

Mr. Heukelekian said the high rate of digestion appeared to have been achieved by simultaneous control of sludge thickening, effective utilization of tank volume, and uniform feeding of raw sludge. Questions raised are the dewaterability of sludge from high-rate digestion; the storage capacity requirement of digested sludge for various methods of sludge disposal; the effect of interruption of feeding on subsequent digestion; storage capacity requirement for feeding raw sludge at a continuous rate with fluctuating solids received; and an effective method of utilizing tank capacity by mechanical means.

Mr. King said it is doubtful if the total volume of digestion tanks can ever be fully utilized for the digestion process in plant-size tanks; questioning the extent to which effective displacement can be economically increased by means of mixing, or if it would be economical, considering the increased costs involved in providing such mixing.

"Loading to Failure of a Pilot High-Rate Digester". By Wilbur N. Torpey, Engineer of Treatment, Bureau of Sewage Disposal Operation, New York City. Discussions by Harry E. Schlenz, H. Heukelekian and Henry R. King. *Sewage and Industrial Wastes,* February.

Determinations for Controlling Digestion

The author advocates using volatile acids and total alkalinity determinations instead of, or in addition to, the conventional pH determination, in the control of digestion. During the breaking in of a digester, daily tests showed variations in gas production to be accompanied by noticeable changes in acid and alkalinity tests, while the pH changed very slightly and at intervals of 4 to 10 days. Thus the former gave

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M. A. Doss, Superintendent of Grounds at Texas Christian University Ft. Worth, Texas. View shows part of the 168 acre campus that is landscaped and beautified.

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"Minimum requirements for leveling, fertilization and beautifying the campus calls for 4,800 yards of dirt per year. Privately contracted for, this dirt delivered but not spread, would cost at least $1.50 per yard, or $7,200 per year. During the past four years it has required three men and a driver to haul and spread 24 yards in one day, at an average cost of 75¢ per yard. Since the acquisition of a front end loader that permits one man to Load, Haul and Spread we have averaged moving 35 yards per day, at a cost of about 15¢ per yard. Figuring the original investment (truck and loader at $5,000), the driver's salary, gas and oil at $3,500 per year, with complete depreciation of equipment in 10 years . . . it'll cost $32,000 less than it would if we had contracted for the same work" reports Mr. Doss.

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quicker and more easily detected notification of changes in the digester than did the pH changes. In breaking in a second tank, total alkalinity was adopted for testing the supernatant, principally because a clearer sample could be obtained, making it easier to recognize the end-point.

"Seeding and Control of Volatile Acids and Alkalinities". By S. M. Cristofano, Supt. of Plant, Englewood, Colo. *Wastes Engineering*, March.

Effect of Sludge On Soil Nitrification

Experiments to study the effect of dried sewage sludge on nitrification in soil, by comparing it with untreated soil, and with sludge-treated soil with the addition of ammonium sulfate, of cottonseed meal, and of dried blood, indicated that adding sludge gave nitrate values as high as, and usually greater than, those obtained from analogous combinations without added sludge. The sewage from which this sludge was obtained contained no industrial wastes.

"Effect of Dried Sewage Sludge on Nitrification in Soil". By James E. Fuller and G. W. Jourdian, Univ. of Massachusetts. *Sewage and Industrial Wastes*, February.

Houseflies In Sewage Sludge

Studies with sludge digested in laboratory bottles, to which housefly larvae were applied, revealed that houseflies will breed in 40-day digested sludge under laboratory conditions; also, they were found breeding in great numbers on drying beds under field conditions. The pH, total solids, volatile solids, and moisture content had no significant effects on the number produced; but the pupal size appeared to increase with the increase in volatile solids content.

"Housefly Breeding in Sewage Sludge". By Harold W. Wolf, Sr. Asst. San. Engr., U.S.P.H.S. *Sewage and Industrial Wastes*, February.

Other Articles

"Lagoon Purification Performance in South Dakota". In nine towns of 100 to 2800 population. By M. O. Allum, S. D. Dept. of Health, American City, March.

"Sewage Gas Savings" by use of dual-fuel engines at Lansing, Mich.; and a "Dual-Fuel Triumph" at Lake Providence, La. American City, March.

"Sanitary Fills and Incinerators" both used by New York City. By Casimir A. Rogers, Dept. of Sanitation. American City, March.

"Detecting Sewage Gas Leaks Automatically" from gas pipes at the Canton, Ohio treatment plant. Public Works, April.

"Getting the Best Performance From Your **Sewage Works"**. Chapter V. By Le Roy W. Van Kleeck. Wastes Engineering, March.

"Financing Sewage Facilities by Sewer Service Charges". By John J. Baffa. Wastes Engineering, March.

"Slower Dosing of **Percolating Filters"**. Discussion of several reports. The Surveyor, March 5.

"For Better Control of **Sludge Digestion"** by controlling temperature. By Jack L. Staunton. Engineering News-Record, March 24.

"Flow Measurement in Sewage Works". Description of current methods. By Walter H. Brown, Builders-Providence, Inc., and George E. Symons. Sewage and Industrial Wastes, February.

"Experimental Work on Sewage Treatment at Reading", England. Biological filtration of sewage and vacuum filtration of sludge. The Surveyor, March 12.

"Cast-in-Place Sewer Has **Plastic Lining"** at Los Angeles. Engineering News-Record, March 17.

"Modern Sewage Works for **Meredith, N. H.** By Edwin B. Cobb. Water & Sewage Works, March.

"Controlled Humus Production by Separate Sludge **Digestion and Drying."** By Leonard L. Langford, Pacific Flush Tank Co. Water & Sewage Works, March.

"Industrial Wastes are Problem in Sewage Treatment Plant Operation" at Cranston, R. I. Public Works, April.

"Pollution Abatement by the **Interstate Sanitation Commission** in 1954." Public Works, April.

"Standby Power and Overflow Prevention for **Sewage Pumping Stations"** on Baltimore's watershed. Public Works, April.

"Effect of Bacterial Flora on **Deoxygenation."** By William L. Tidwell and J. H. Sorrels, Texas Engineering Experiment Station. Sewage and Industrial Wastes, February.

• • •

Property Taxes & Cost of City Government

Property taxes paid by multiple-family residences, stores, and office buildings in Greenwich, Conn., fall $820,000 a year short of meeting the appropriate share of the cost of government that can be allocated to these classes of property. Properties which paid taxes in excess of the cost of supplying services were single family homes $657,000 excess, industries $386,000, and vacant land $225,000.

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OXIDATION POND STUDIES

BASIC research has been carried on at the Balcones Research Center of the University of Texas on the operation of waste water oxidation ponds, types of algae associated with such ponds, biological treatment of laboratory wastes, removal of radioactive isotopes by oxidation ponds and the concentration of algae. The program is summarized in the March-April, 1955, issue of Engineering-Science News, publication of the Research Center, as follows:

Oxidation Ponds—The oxidation pond, as a means of treating waste water, is well adapted for use by small communities and industries where land costs are low and climatic conditions are such that algae will flourish throughout the year. The fact that algae, in addition to bacteria, will effectively take up radioactivity logically leads to a consideration of the oxidation pond as a medium for growth of algae which, in addition to contributing toward the stabilization of organic matter, will remove radioactive isotopes from solution to particulate matter that is removable from the liquid.

Three 1,200-gallon and one 5,000-gallon oxidation ponds have been constructed and used to determine the amount of bottom sediments, effect of removing some of the algae population at various stages of treatment, and some of the operational information required to obtain maximum efficiency. The effect of the amount of decomposable organic loading has been investigated. BOD measurements were made at various stages of treatment and correlated with other types of waste treatment processes.

Laboratory tests using 10-gallon aquaria have also been continued, and two such experiments have been completed. Controlled experiments using synthetic nutrients are under way in an attempt to determine some of the factors which will influence the operation of oxidation ponds.

Filter Leaf—Filter aids consisting of carbon, crushed graphite ore, paper, and cellulose-containing products were investigated and compared with diatomaceous earth. The objective was to obtain a filtering material that would provide a high degree of algae removal and also maintain a high filtration rate throughout most of the filtering cycle. The diatomite filter aid having the largest particle size (Celite 545), marketed by the Johns-Manville Corporation, has excellent algae removal characteristics and a moderately high filtering rate. Algae do not penetrate the precoat surfaces of rotary vacuum filters in excessive numbers and the algae-diatomite films can be removed in thicknesses of less than 0.005 of an inch.

Rotary Vacuum Filtration—Filtration tests are planned using a rotary vacuum filter and the several filter aids previously tested with the filter leaf. The Eimco Corporation has furnished a filter having 4 square feet of filtering area and 33 1/3 percent submergence, which is adaptable for either conventional vacuum filtration or precoat filtration. It is anticipated that useful filtration data will be obtained since many of the precoat formation and algae filtration problems have been overcome.

Fine Screen—The usefulness of fine screens to concentrate algae are of considerable interest because of reduced costs as compard to other methods of separation. One of the more promising separators tested utilizes a No. 325 mesh brass wire cloth. Vibration is accomplished by a combination of two eccentric weights, one on the upper end of the motor shaft and the other at the lower end. The center of gravity of the uppermost weight is coincident with the center of gravity of the vibrating mechanism and thus vibration is caused by a rotation of this upper weight.

Coagulation—Coagulation studies were initiated to demonstrate the application of iron-lime floc for algae removal. It was believed that the least expensive floc which could be used in conjunction with the predominantly alkaline oxidation ponds would result in adequate algae removal. The results of jar tests and Accelator experiments are promising and the path to more coagulation tests is defined.

Radioactivity Uptake—Of major interest in the oxidation pond studies has been the removal of radioactive isotopes from liquid wastes. Radioactive isotopes of strontium, cesium, cerium, phosphorus and iodine have been studied. Considerable progress also has been made in removing long-lived mixed fission products.

This research program is under the direction of Dr. E. F. Gloyna.

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PUBLIC WORKS DIGESTS

The HIGHWAY AND AIRPORT *Digest*

Mast Arm Suspension Of Street Traffic Signals

New York City has begun a program of installing 350 traffic signals of a new type in some of its most heavily travelled arteries. This new type consists of a 20-ft. high vertical shaft from which a 20 ft. long curved arm extends over the roadway, where the signals supported directly over the roadway do not have to compete with neon signs and other bright lights. The height eliminates obstruction from view caused by buses and trucks. The units are made of a special low-alloy, high-tensile steel.

"New York City's New Signal Mast Arm". By Lawrence Lawton, Director of Traffic. *Public Works*, April.

Earth Wagon Designed To Meet Legal Limitations

An earth wagon recently went into construction service in California which was designed with the maximum length, width, and carrying capacity, permissible by the state highway regulations, for use as a trailer in both on and off highway hauling. This trailer is 35 ft. long (48 ft. including tractor), and 8 ft. maximum width. It will carry 24 cu. yd. heaped load (30 tons or more) on 8 pairs of 1,000 x 20 truck tires. It has specially designed dumping gates for depositing the load in a single windrow narrow enough for good straddling.

"30-Ton Bottom-Dump Semi-trailers Built for Both On and Off Highway Hauling". *Roads and Streets*, March.

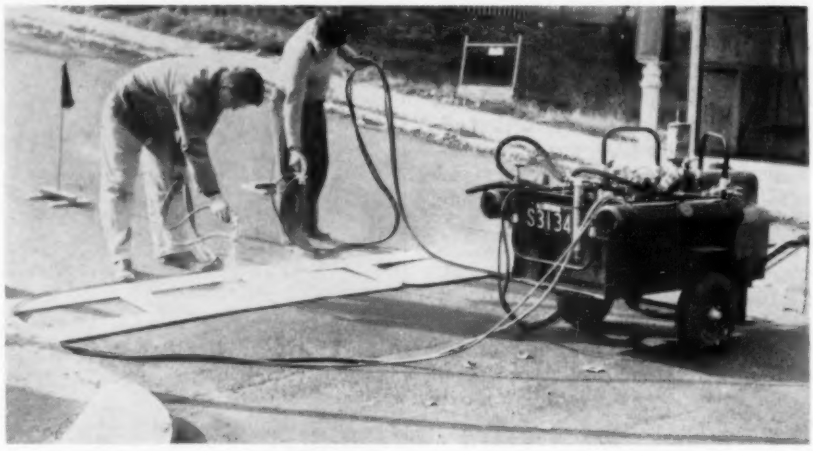
Resealing Pavement Joints

In cleaning and resealing 228,000 ft. of contraction and expansion joints in the runways at an airport in Winston-Salem, N. C., it was found that many joints were too wide to be handled by a conventional groover without making several passes, which would be expensive. The answer was found in the use of a subsoiler—a piece of farm equipment which carries a plow blade of any desired width; they found a 2½ inch blade most effective. This cleaned the joint thoroughly without spalling the sides.

"Airport Runway Joint Maintenance". By Richard E. Mooney, Airport Manager. *American City*, March.

Effects of Increasing Axle Loadings in California

California law now restricts the loadings on single axles to 18,000 pounds and on closely spaced tandem axles to 32,000 pounds. From time to time efforts have been made to have state laws passed increasing these limits. At the request of the legislature, the Division of Highways has presented a report with respect to the effect such increase would have on highway construction and maintenance. This report is based on past experience, results from test roads, and technical considerations. Briefly summarized, their conclusions are as follows: Since 1947, the number of commercial vehicles has increased 40 percent and their average weight 18 percent. Even the increase of axle loadings within the present legal limits has increased costs of road construction and of road repair and shortened the life of existing pavements. The annual cost of reinforcement and maintenance of the travel lanes on state highways has risen to approximately $24,000,000. Any increase in axle loading would substantially increase this. If axle loadings were increased 25 percent, strengthening of the pavement would be required on older highways at a cost estimated to be $96,000,000; and the cost of new construction would be increased by 10 percent, or by $14,000,0000 for



Reflectorized Markings Sprayed on Pavements

THIS ILLUSTRATION shows the "two-gun" method for placing reflectorized pavement markings used by the Massachusetts Department of Public Works. Two spray guns are used, one of which applies the paint inside the stencil outline while the other follows closely to apply Prismo glass beads for reflectorization. Through a choice of stencils, words, symbols, crosswalk lines and other markings are placed as needed. Both spray guns are powered by a Model T-33 Lindsay portable air compressor, one of thirty purchased by the State for use in its pavement marking program and for other work.

Why Commissioner McLaurin likes CAT* No. 12s

As road commissioner of Lynn County, Texas, Beatrice McLaurin knows road maintenance equipment. "The county has owned other machines," she says, "but we find that Caterpillar Motor Graders give us the most dependable and economical operation."

The county's two CAT* No. 12s are shown here raising the road level four to five feet along a stretch near Tahoke, Texas. The two No. 12s, one with a Domor elevating attachment, handle the fill, and grade and dress the surface, of one mile of the 40-foot road every day.

According to Mrs. McLaurin, Lynn County chose Caterpillar No. 12s for their excellent reputation—of all Caterpillar Motor Graders ever built, 99% are still in use. Another feature that the County Road Commission likes: operators are comfortable, and therefore efficient, thanks to Caterpillar handling ease.

Caterpillar's positive, mechanical controls *stay put*, without clogging or "creeping." The blade can be shifted throughout a complete range of positions quickly and easily, thanks to an exclusive curved side shift rack. For fast and accurate work, the operator can see the blade and both front wheels without standing up. *Caterpillar has the best visibility of any motor grader.*

Only Cat Motor Graders are *built* — not assembled — by a single manufacturer. This means that blade capacity, engine power and working speed are carefully matched. And it means a single source for parts and service—your dependable Caterpillar Dealer. Ask him for proof that these motor graders are your wisest investment of the taxpayer's dollar.

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CATERPILLAR*

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the amount of construction scheduled for this year.

"Truck Loads". *California Highways and Public Works,* January-February.

Soils Laboratories For Counties

Should county highway departments maintain soils laboratories? Twelve county highway officials expressed an opinion on this subject. Some think it would be impracticable and uneconomical for a small or medium-sized county; especially as most state highway departments will test samples of soils sent by counties. Those highway administrators who have their own laboratories think they can do their own testing more economically than sending it to private laboratories; and more tests will be made and better control of road materials maintained.

"Soils Laboratories for Counties?" *Better Roads,* March.

Selecting Construction Equipment

In choosing a piece of construction equipment, important factors are 1—Accessibility of parts. 2—Ease of operation—a comfortable driver's seat, good visibility to front and both sides and rear, and the position and ease of the control. 3—Ample horsepower; the closer the gross vehicle weight comes to 300 lb. per hp, the better the performance. 4—Adaptability; consider possible future work as well as present. The author here considers only the "off-the-road" rear-dump truck, the bottom-dump, and the self-propelled scraper. Rear dumps are used when the material hauled is large rock or other bulky material; when maximum grade and spotting abilities are required, or maximum flexibility for hauling a variety of materials, or dumping into restricted hoppers; and when the truck is subject to severe loading impact when under a large shovel, dragline or loading hopper.

The bottom-dump is primarily used in hauling free-flowing material over medium and long hauls, where grades are moderate and where high flotation is required. The self-propelled scraper has advantages over dump trucks for several kinds of work; it can operate under some conditions where dump trucks cannot operate at all. The twin-engine scraper has become very popular recently.

"Use of Construction Equipment —Choice, Capacity, Economy," By William B. Dickerson, Gen'l Motors Corp. *Civil Engineering,* March.

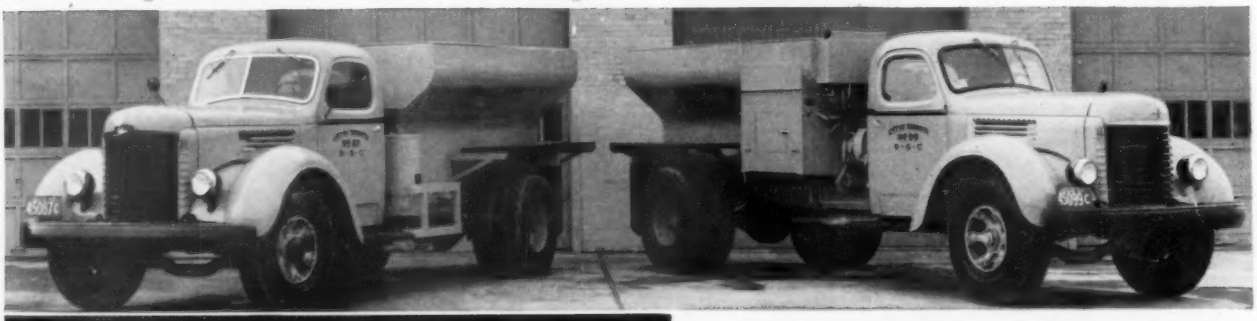
Action of Thawing Agents on Concrete Roads

The Bureau of Public Roads in 1948 started investicgations on methods of protecting the wearing surface of concrete against the action of calcium chloride.

"It was found that resistance to scaling was affected by air content, type of air-entraining admixture, surface treatments or coats, admixtures of oils, inhibitors, fly ash as a replacement for portland cement, rate of application of calcium chloride, curing methods, thawing agents other than calcium chloride or common salt, and by the vacuum method of placing concrete." Details of the tests and conclusions are given in the article.

"Factors Affecting Resistance of Portland Cement Concrete to Scaling Action of Thawing Agents." Albert G. Timms, Research Engr, BPR. *Public Roads,* April.

Champions Of The "Open" Road . . .



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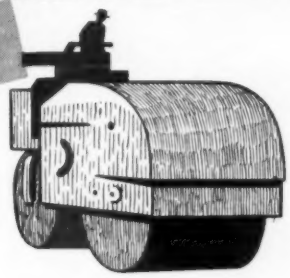

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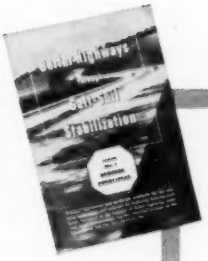

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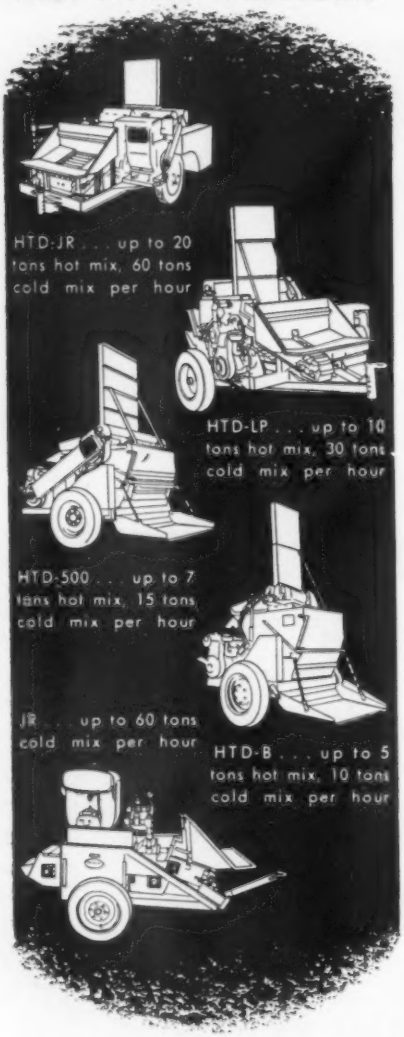
HTD-JR . . . up to 20 tons hot mix, 60 tons cold mix per hour
HTD-LP . . . up to 10 tons hot mix, 30 tons cold mix per hour
HTD-500 . . . up to 7 tons hot mix, 15 tons cold mix per hour
JR . . . up to 60 tons cold mix per hour
HTD-B . . . up to 5 tons hot mix, 10 tons cold mix per hour

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K. E. McConnaughay
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Borings For Subsurface Data

Maryland State Roads Commission obtains disturbed soil sample for learning soil conditions in advance of road planning, and furnishes the information to bidders on construction but with no guarantees of their accuracy. The borings are made with three types of augers: 6-in. augers mounted on jeeps with power take-off; 4-in. augers, gasoline powered; and hand augers of 2, 4, 6 and 10 in. diameters. Borings are made at an approximate spacing of 300 ft. on right, left and center line, to a depth of at least 3 ft. below design subgrade in cuts, and 3 ft. below original surface in fills. In mucky areas the depth of muck is determined by probing. Depths to rock and to water table, to bottom of root mat, and general nature of soil are noted, also.

Virginia Dept. of Highways employs a soils engineer and staff, and a geologist; and district materials engineers in each of the eight construction districts. For borings, they use an 8-in. Buda earth auger or 5-in. Jeep augers. The former can, if necessary, bore to 100 ft. depth; the Jeep augers to 30 ft. depth. Field observations are made as to moisture conditions, to assist in planning for drainage. The rock profile is determined by an electrical resistivity survey in some areas, and the result checked against the boring data.

"Advance Borings For Soils Data". By J. Eldridge Wood, Maryland State Roads Comm., and A. B. Cornthwaite, Virginia Dept. of Highways. *Roads and Streets*, March.

Joint Sawing In Heavy Pavements

Some highway departments have controlled contraction cracking in concrete pavements by placing control joints during construction at 50 to 75-ft. intervals; needed intermediate joints may be cut hours or even days later. But for pavements 12 to 20-in. thick, used in airfields, it has been found that all joints must be sawed as early as possible, before the internal temperature of the slab drops appreciably. Studies made by Corps of Engineers, Omaha District, indicated that, in general, joints should be sawed in the order of pouring, before the temperature of the concrete drops appreciably; that the practical method of determining when to make a cut is by trial sawing, noting the appearance of the cut. Most uncontrolled cracks occur during cooling rains or sudden temperature drops. A saw cut equal to one-sixth the pavement thickness has been found sufficient to control cracking.

"Summing Up on Joint Sawing for Heavy Airfield Pavements". By Herbert B. Erickson, Corps of Engineers. *Roads and Streets*, March.

Control of Roadside Weeds

For several years California has endeavored to control roadside vegetation by use of various chemicals, none of which has proved to be entirely satisfactory. A recently developed compound, chlorophenyl dimethylurea, called "Telvar W", has been used extensively. It is not hazardous from the standpoint of fire or harmful to those applying it. Much less is required than of sodium chlorate. It is not soluble and must be agitated vigorously during application. It appears to be retained in the upper part of the ground surface and attack the later germination of dormant seeds.

"California's Roadside Vegetation Killed With Chemicals". By R. D. Kinsey and S. Evans, Calif. Div. of Engineers. *Civil Engineering*, March.

Chemical Control of Weeds and Wildlife

Commenting on the possible objection of those interested in wildlife to the use of chemicals for control of roadside weeds, the Director of the U.S. Fish and Wildlife Service says that the danger is not in the toxicity of these materials to birds, mammals and fish, but in the destroying of valuable food and cover plants. In intensively farmed land, the brush along the roadside may provide the principal protective cover for rabbits, quail and other wildlife.

"Chemical Control of Roadside Weeds and Brush". By John L. Farley, Dir., Fish and Wildlife Service. *Public Works*, April.

Grade Crossing Pavements in Texas

Five types of pavements at grade crossings are used in Texas: 1—full asphalt pavement on flexible base; cheap, but breaks up due to movement of railroad ties; and expensive to maintain. 2—Asphalt pavement with treated timber headers along both sides of the rails; better than No. 1, but not desirable, for the same reasons. 3—Treated

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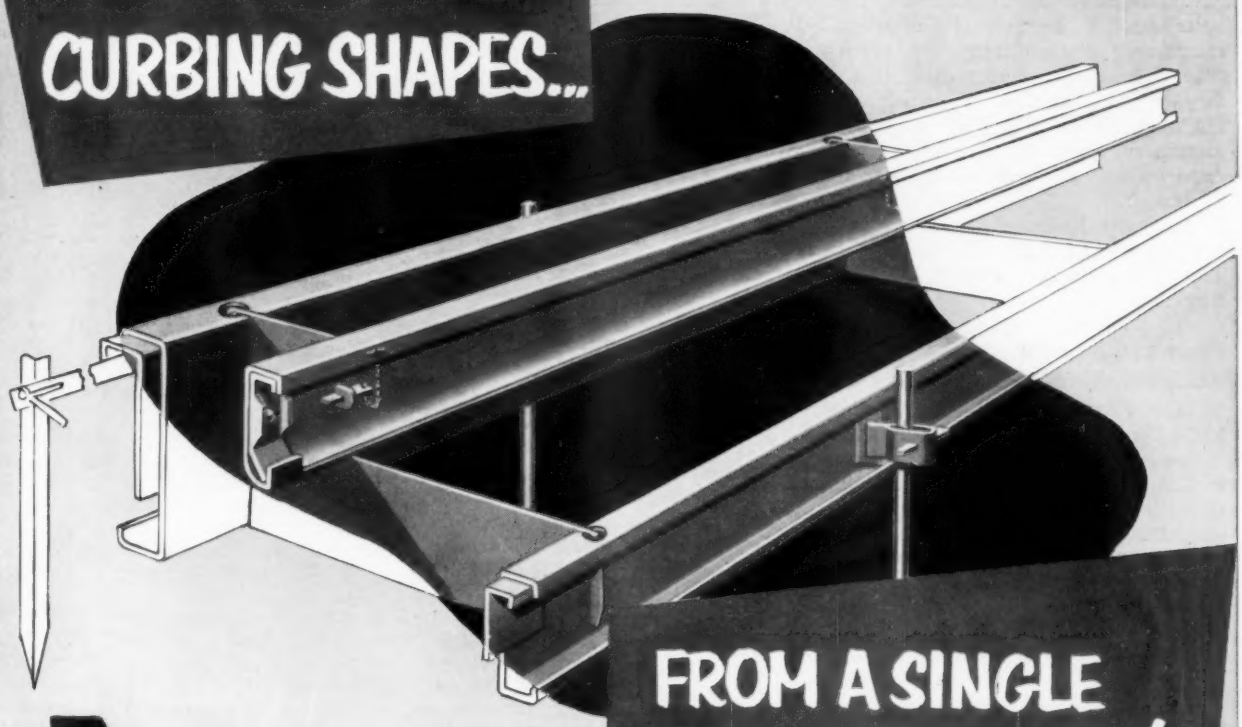

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timber pavement for the full length of the ties; reasonably satisfactory, not affected so much by train traffic and easily replaced. 4—Concrete slab; required by Department for spur tracks because it requires minimum of maintenance; gives smooth riding surface; difficult to replace if location of track is changed. 5—Metal grating; most expensive type; being tried as an experiment; gives excellent riding surface.

"Highway Railroad Grade Crossing Pavements". By H. M. Taylor, Jr., Office Engr. *Public Works*, April.

Freeways Reduce Accident Rates

As of January 1, 1955, California had 1275 miles of multilane divided highway in operation; 170 miles of which are full freeways; with 150 miles additional under contract or advertised. The accident rates on these have consistently been approximately one-half the rate for conventional rural state highways. Freeways also exert a beneficial safety effect on nearby roads and streets. Accident rates have been materially reduced on a city-wide basis after the opening of a freeway through or around moderate-sized California cities, and have been reduced to some extent in metropolitan areas as a reflection of an expanding freeway network. They are self-liquidating in that they repay their total cost in savings to the motorists in a few years. This reduction of accidents on freeways as elsewhere is due to a considerable extent to the enforcement of traffic regulations and driver education.

"Safer Highways". By J. W. Vickrey, Asst. State H'way. Engr., and R. J. Israel, Asst. Traffic Engr. *California Highways*, February.

Rubber Railroad Crossings

Akron, O., has laid the first rubber railroad crossing, installed on the main track of the Erie RR. This material is claimed to offer the smoothest and longest-lasting railroad crossing yet devised.

"New Rubber Railroad Crossing". The *Highway Magazine*, March.

Other Articles

"Surface Treatment Reviewed by Asphalt Technologists." At meeting of Assn. of Asphalt Paving Technologists. Roads and Streets, March.

"Dense Tar Surfacing For Use on Airfields." British tests and developments. The Surveyor, Feb. 19. Municipal Engineering, Feb. 18. Contractors Record, Feb. 16.

"Soil Stabilization With Chemicals." British practise. By H. E. Brooke-Bradley. Municipal Engineering, Feb. 11.

"Snow Poles." Driving them by air hammer. California Highways and Public Works, Jan.-Feb.

"Growth Retarders for Roadside Verges: The Use of Maleic Hydrazide." Roads and Road Construction, February.

"The **Compaction of Earthworks** and the Performance of Plant." By W. A. Lewis, Road Research Laboratory. Contractors Record, Feb. 16.

"Building Roads and Airfields Under **Battle Conditions.**" Tests by the Royal Engineers, England. The Surveyor, March 5.

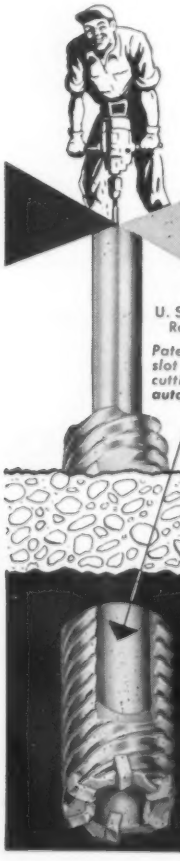
"Prestressed Costs Comparable to Reinforced for Concrete Roads." The Surveyor, March 5.

"Economical Benefits of **Radio** for Highway Departments", and also for contractors. By H. A. Radzikowski, USBPR. Better Roads, March.

"The Laboratory" a necessity for soil stabilization. By H. E. Brooke-Bradley. Municipal Engineering (England), Feb. 25.

"Emulsified **Asphalt Stabilization** in Pinellas County, Florida." By C. A. Peterson, Dir. of Pub. Wks. Public Works, April.

"Street Maintenance in Los Angeles." By Guy Browning Arthur. Public Works, April.



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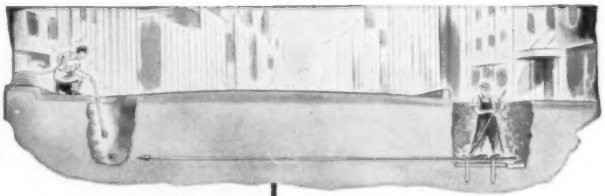
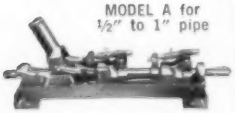
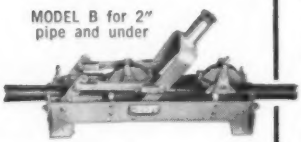



MODEL A for ½" to 1" pipe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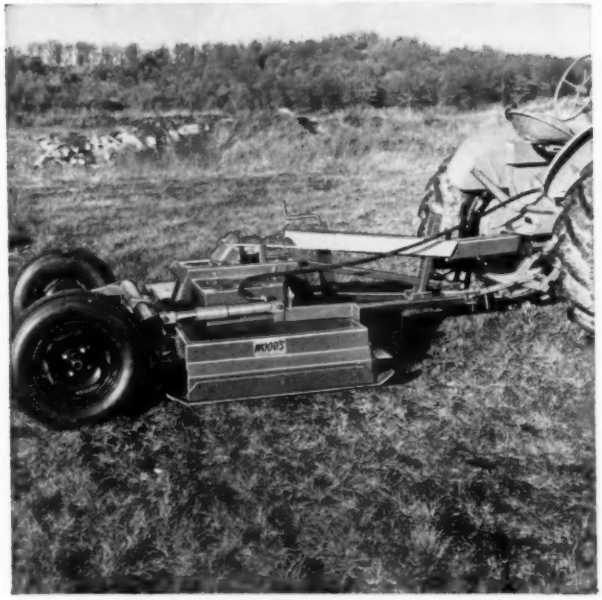

MODEL 80 (61 similar)

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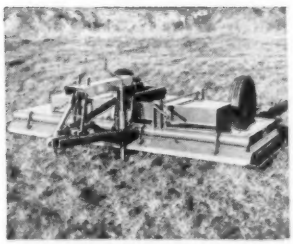
Wood's PTO-operated tractor rotaries do a clean and even job of mowing grass down to an inch high or cutting thick waist-high brush. Easy and accurate adjustment is handy on all models.

There are 12 models available in hydraulic lift or drawbar pull-type for any size tractor—42″ to 114″ cut—adjustable from ground to 14″ high. Wood's cutters mow, clip or shred and mulch leaves—close to trees, fences or buildings.

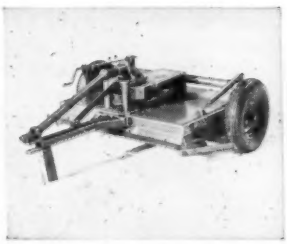
There are 1, 2 and 3 blade models. Blades overlap for clean cutting. Equipped with shock absorbing V-Belt drive, 3/16″ boiler plate housing, 15″ drop-center wheels or 8″ with non-pneumatic tires. All working parts enclosed.

Large Selection of Models

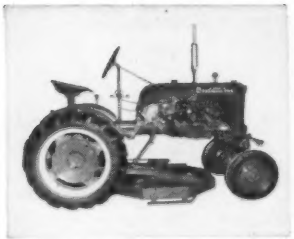
Model 42C, 42A—42″ cut, single blade, for Farmall Cub and Super A. **Model 42F**—Same as 42C but rear-mounted for the Fast-Hitch Cub. **Model 5**—60″ cut, single blade, for 2 plow tractors. **Model M5**—Same as 5 but mounts on 3-point hitches such as Ford. **Model 61**—61″ cut, double blade, for 2 plow tractors. **Model M61**—Same as 61 but mounts on 3-point hitches. **Model 80**—80″ cut, double blade, for 2-3 plow tractors. **MODEL O-80**—Same with off-set drive for working under low trees. **Model M80**—Same as 80 but mounts on 3-point hitches. **Model 114**—114″ cut, triple blade, for 3-4 plow tractors. **Model 114E**—Same as model 114 but with mounted engine for use with small tractors.



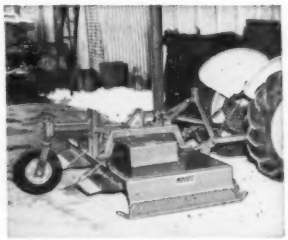
MODEL 114



MODEL 5

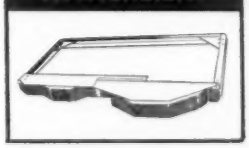


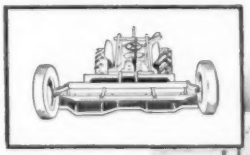
MODEL 42C (42A similar)



MODEL M80 (M61 similar)

LEAF MULCHING ATTACHMENT





Leaf Mulcher available for Models 42F, 42C, 42A, 61, M61, 80 and M80.

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PUBLIC WORKS DIGESTS

The WATER WORKS *Digest*

Feasibility of Biological Warfare

The author gives a list of 30 potential diseases caused by bacteria, fungus, protozoa, rickettsia, toxins and virus. The feaibility of obtaining these unobtrusively in the quantities necessary to produce widespread disease is questionable. Little is known of the oral dosages of these pathogenic materials necessary to contaminate seriously a drinking water supply. Of several chemical poisons that might be used, the amounts needed to affect the population is estimated to be 10,000 lb. or more per million gallons. The detection of the presence of these materials in the water supply may be very difficult. It is believed that the distribution system would be a more attractive target than the source of supply. Free chlorine residuals in important segments of the distribution system represent the best current means of protection, but not always a complete one.

"Feasibility of Biological Warfare Against Public Water Supplies". By Bernard B. Berger, U.S.P.H.S.; and Albert H. Stevenson, Federal Civil Defense Administration. *Journal, AWW Assn.*, February.

Dust Control In A Softening Plant

The municipal waterworks of Bucyrus, O., in constructing a new building for its treatment plant, included provision for controlling the dust created in handling the lime, alum and soda ash. The lime is delivered in bulk in 45-ton loads; the others are delivered in bags and produce dust only during batching operations. Dust control increases the working lives of the equipment in the plant; reduces maintenance; increases the efficiencies and useful lives of motors, instrument control panels, etc.; is a protection to plant operators; and reclaims the dust for use in the softening operations. Local exhaust ventilation was selected, with hoods at each dust-producing point. It collects about 50 lb. of dust from each 45-ton load of lime while it is being transferred into the plant. This dust, plus about 300 lb. from the soda ash and alum, is collected and used in the softening operation.

"Dust Control Keeps Water Works Plant Clean". *Public Works*, April.

Designing Booster Stations

The author describes the method of designing such stations, as applied to a section of the Detroit metropolitan area. This included determining the required consumption and area to be served, the volume and type of storage, selection of the pumping units, motors, starters and voltage, automatic controls, protection against surge, and miscellaneous details. Since 1944 the Wayne County Board of County Road Commissioners has been operating a semi-metropolitan authority to provide water supply and sewage treatment facilities to a considerable portion of the county, which necessitated the operation of 4 booster stations with elevated storage and 2 with ground level storage.

"Booster Stations". By A. T. Kunze, San. Engr., Wayne Co. Bd. of County Road Com'rs. *Journal, AWW Ass'n*, February.

Employee Comfort In Meter Repair Shop

In the design of the meter repair shop of Long Beach, Calif. the comfort and health of the employees were given great consideration. The shop is provided with adequate light, ventilation, tools, heating units, and soft rubber mats in the working areas. The ceiling of the main shop has a covering of 1-in. acoustic tile, which materially reduces the noise from the operation of the impact wrenches, the compressed air used in cleaning and drying meter parts, and the like. An acid room, where the measuring chambers of the meters are cleaned in an acid bath, has been provided entirely separated from the meter shop. The acid jars are covered with an acid-proof hood connected to a suction fan, which carries off the fumes, and the room itself is provided with a separate ventilator.

This is one feature of a very complete meter shop for maintaining the 63,000 meters in the system. A full description of the equipment is given in this article.

"Long Beach Meter Repair Shop and Testing Facilities". By Fred S. Porter, Div. Engr. of Water Dept. *Journal AWW Assn.*, February.

Soil Cement For Reservoir Lining

Alamagordo, N. M. in 1953 built two 40,000,000-gallon open storage reservoirs, each 405 ft. square on the bottom and 28 ft. deep, with side slopes of 1½ to 1. The sides are lined with 3-inch concrete, heavily reinforced; but to reduce the cost, soil cement was used for lining the more than 7 acres of bottom. The bottom was mostly a rocky material, and was covered with a soil-cement mixture of sandy-silt-loam containing 12 percent of cement. This was placed with normal road construction equipment, rolling being performed with rubber-tired and steel wheel rollers, and an asphalt curing membrane being used. The concrete lining cost $3.60 per sq. yd.; the soil-cement bottom cost $0.847 per sq. yd.

"Concrete and Soil-Cement for Economical Reservoir Lining". By Walter Mullins, Mayor. *Public Works*, April.

Prestressed Concrete Tanks

The East Bay Municipal Utility Dist. in California has in service 34 prestressed concrete tanks with capacities ranging from 0.2 to 5 mil. gal., and four more are under construction, including one of 12 mil. gal. capacity. The ultimate costs of these tanks have been approximately the same as for steel tanks. All the tanks have rendered ex-

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cellent service. Maintenance costs have been practically insignificant. The author describes the development from the bar-stressed Hewett tanks of the 1920's, to the present use of helical-wound wire and of tensioned wire cables. Most leakage from these tanks has been through the floors, and a description is given of a special design calculated to prevent this.

"Prestressed Concrete Tanks at East Bay". By J. W. Trahern, Supervising Engr., East Bay Mun. Util. Dist. *Journal, AWW Ass'n*, February.

Filtering Sludge From Lime Softening

Galion, Ohio, reduces its surface water supply from 350 ppm total hardness, and its well supply of 500-550 ppm, to 75-80 ppm. The amount of lime sludge produced became too great for discharge into either the city sewers or the river, and in 1954 the city placed in operation a coil-spring vacuum filter to cake it—believed to be the first city to employ such equipment for this purpose. The filter has 100 sq. ft. of filtering surface and produces about 800 lb. of cake per hour containing about 70 percent moisture. Batch operation seems to be advisable. Experience at Galion indicates that the sludge should be held in a concentration tank for 1-1½ hr. before filtering. The cake is air dried on land, resembling chalk after one or two weeks of average weather.

"Methods of Lime Softening Sludge Disposal". By F. H. Waring, Chf. San. Eng'r, Ohio State Dept. of Health. *Journal, Am WW Assn.*, February.

Group Construction Of a Water Supply System

Furnishing water for a proposed large-scale housing project in Colorado presented the difficult problem of estimating the future population to be served and therefore the capacity which it would be economical to provide. To minimize the risk, the developer of the project concentrated sales and construction in groups of 400-500 homes, and planned a flexible system of wells and also a plant for treating surface water to be obtained from an irrigation canal. Only one well per section is drilled in any of the deep sandstone aquifiers, in order to keep interference between wells to a minimum. As additional groups of homes are opened up, new wells and pumping plants will be provided. While a large plant built at one time would be less expensive than the continual expansion of smaller units, the ultimate demand will depend on the actual growth of the new community; and caution seemed to indicate this plan as preferable.

"Problems of New Water Utilities". By S. J. Joseph, V. P. and Gen'l. Mgr., Northwest Utilities Co. *Journal, AWW Assn*, February.

Radio Communication In A 300 Square Mile Area

The Philadelphia Suburban Water Co. serves 500,000 persons in an area of 300 sq. mi. through 1570 miles of pipe. In 1947 it instituted a radio communication system. Receiver-transmitters were installed in 7 cars by the Bell Telephone Co., which charged $22 a month per car. Later the Telephone Co. contracted to provide a complete two-way radio communication service, including a central station, 6 substations and 21 mobile car units, rented on a monthly basis at $85 per month for the base station and $43 for each substation. The local power company normally supplies the base stations, but the water company maintains gasoline driven standby units. The benefits of such

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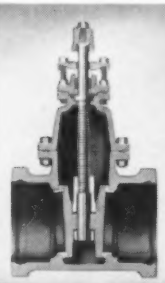
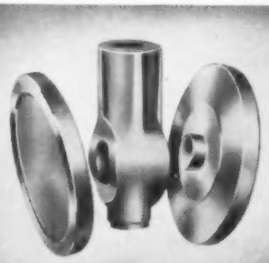


Strip it down to a sectional view and you can see why interruptions in service are rare. There's virtually nothing to go wrong — none of the complicated small parts that fail in an emergency because sediment and scale render them inoperable.



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"Water Works Radio in Suburban Philadelphia." By George H. Dann, Vice-Pres. & Gen. Mgr. *Journal, AWW Ass'n,* February.

High-Rate Filtration at Washington, D. C.

A study of high-rate filtration is being carried on at the Dalecarlia filter plant, Washington, D. C. Results up to October, 1954 form the basis for the following conclusions: Water meeting present standards can be produced at rates of filtration up to 5 gpm per sq. ft. At temperatures ranging from 50° to 72° F—probably 34° to 85°, provided efficient pretreatment (flocculation and sedimentation) is maintained, super- or free-residual chlorination is employed, and qualified operating and supervisory personnel are available. There is little advantage in operating existing filters designed for 2 gpm above 4 gpm. Filter effluent piping and rate controllers should be designed to keep the head losses low. Anthracite of 0.76 mm effective size was more favorable than sand of 0.56 mm in all phases of head losses, flow and length of run. Under high-rate filtration, washwater rate can be expected to increase from about 0.3 to 0.8 percent.

"Study of High-Rate Filtration at the Dalecarlia Plant, Washington". By Norman E. Jackson, Chf. Dalecarlia Section. *Journal AWW Assn.,* February.

Increasing Filter Capacity by Aeration

A water company in the Netherlands draws it water from the dunes along the North Sea. The iron and manganese in this water caused severe clogging of the rapid sand filters. It became necessary to increase the capacity of the filtration plant, either by adding more filter units or by preventing the rapid clogging of the existing ones. "Pilot tests showed that a rate of at least 15 ft. per hour could be employed provided that complete oxidation of ferrous to ferric iron took place in the water before it was brought on the filters." Sprinkling the water onto the filters was ineffective in furnishing sufficient oxidation, but a device was invented that blows air into the water at the rate of 80 percent of the volume of water and thoroughly mixes them. This fully converts the ferrous compounds to ferric, and much of the organic matter is oxidized before the water reaches the filters. The air is injected with a pressure of 6-7 psi. The same system is in use at a paper mill, but a volume of air equal to that of the water is necessary, reducing the iron content to 0.08 ppm.

"Increasing Filter Capacity by Aeration." By Pieter C. Lindenbergh, Director of WW, Leyden, Netherlands. Journal AWW Ass'n., February.

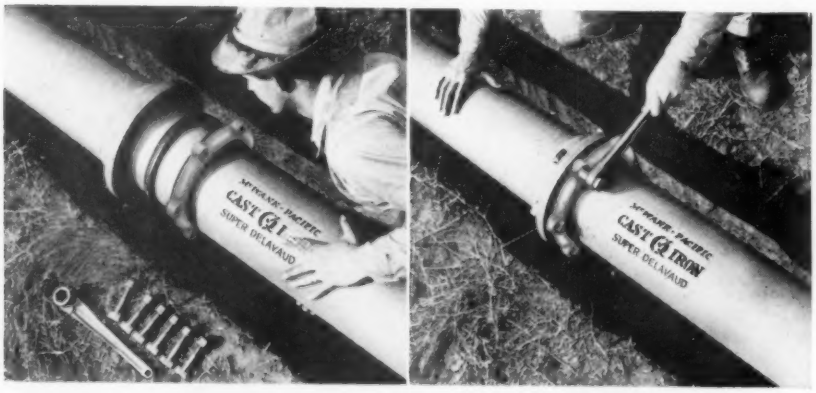
Other Articles

"Policies on **Fringe Area** Service in Ohio." By George J. Van Dorp, Chf. Engr., Toledo, O.; Pierce Bailey, Gen. Supt., Struthers, O., and A. V. Agnew, Supt., Lorain, O. Journal AWW Assn., February.

"**Engineering Assistance** Available to Utility Management", for planning and financing. By John C. Luthin. Journal AWW Assn., February.

"The **Consulting Engineer's** Contribution to Water Works Design and Evaluation." By John A. Carollo. Journal AWW Assn, February.

"**Vacuum Degasification** of Water for Taste and Odor Control." Experience with a pilot plant degasifier. By Ber-



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nard Schiller. Journal AWW Assn., February.

"Florida's **Champion Water Works.**" Winter Park for the fifth time is judged to have the best-organized primary treatment plant. American City, March.

"Modern **Water Rates**" as charged by eleven cities. American City, March.

"**Alabama Short-School** Program." By Arthur N. Beck, State Dept. of Public Health. Jour. AWW Assn., February.

"Preview of the Tenth Edition of **Standard Methods.**" By Louise C. Carty, Chemist, Dept. of Water & Power, Los Angeles, Calif. Journal AWW Assn., February.

"Chloride **Contamination of Ground Water** in Ohio." By A. A. Ulrich, Ohio Water Service Co. Journal AWW Assn., February.

"Value of **Hydrant Flow Tests,**" with instructions for making them. By R. C. Loughead, Michigan Inspection Bureau. Journal AWW Assn., February.

A $1.5 Billion Project. "Water to Meet the Need 30 Years From Now" of the state of California. A project, larger than anything the Federal government has yet undertaken, recommended in a report by the state's Div. of Water Resources. Engineering News-Record, March 10.

A **Stainless Steel Standpipe.** "GM's Newest Fire Protection Really Shines." A 250,000-gal. ellipsoidal tank 138 ft. high made of boiler plate with a bonded finish of ⅛-in. stainless steel, including the three supporting legs, at General Motors Technical Center. Engineering News-Record, March 10.

"Experience With **Activated Silica** Treatment", using seven types of sol. By L. L. Klinger, Project Engr., Consolidated Water Power & Paper Co. Journal AWW Assn., February.

• • •

Duck Pollution Abatement

As a preliminary to possible issuance of orders by the New York Water Pollution Control Board requiring abatement of duck pollution on Long Island, New York, public hearings have been held to give to the 56 owners and operators of duck farms an opportunity to present to the Board the steps each will take to stop pollution of natural waters by discharges of wastes. The discharge of millions of gallons of duck wastes over a period of many years has resulted in gross pollution of the waters in the area. In some basins the waters have been made unfit for bathing and in others pollution has interfered with navigation. Severe damage to shellfish beds has been caused by the presence of high numbers of coliform organisms.

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Knoxville Sewage

(*Continued from page* 104)

Imhoff tank, after pre-chlorination. Sludge is dried on sand beds.

The total cost to citizens in Knoxville is estimated at $468,600 per year beginning this year, and increasing gradually to $612,175 per year in 1987. These estimates cover operating costs, maintenance, and payments on bond principal and interest.

An interesting feature of the financing is a contract with the Knoxville Utilities Board authorizing the collection of sewer service charges beginning July 1, 1953. The Loves Creek plant went into operation in the fall of 1954, but the Third Creek plant will not get started until sometime during the present year, and the buildings will not be finished for three months after that. Thus money began to accumulate against the outgo before the new services were ready. No great objection to this pre-operation charge was made by the users.

The rates amount to approximately 60 percent of the charge for water service. The minimum charge is 51¢ for 500 cu. ft. inside the city limits, and 75¢ outside. These rates are expected to bring in $644,500 per year, and increase gradually to about $1,064,400 by the year 1987.

Greeley and Hansen, consulting engineers of Chicago, have handled the entire project from the beginning. Walter Smith and Associates, of Knoxville, have been the resident engineers. L. C. Bailey, City Engineer of Knoxville, was in charge for the city. James McHugh Construction Company, of Chicago, is the contractor.

• • •

Seismic Surveys

(*Continued from page* 96)

face can be quickly determined.

Highways: Today's essential safety codes—acceptable grades, stability and low maintenance—add up to rugged demands in building modern highways. Plans frequently call for grade separation structures, borrow, cut and fill. The wide use of the seismic survey by the New York State Department of Public Works and highway departments of other states is indicative of its standout performance when it comes to highway location and design. Furthermore, contractors and builders are quick to see the advantage of having reliable data on hand as a basis for making the most economical bids.

Water Supply: Supplies of ground water in large volume for municipal, industrial, recreational and domestic use are obtained from the glacial drift or from unconsolidated overburden. The quickest, surest method for securing preliminary data concerning the depth of sand and gravel which could yield water and the tracing of water-bearing horizons is by seismic means. Groundwater is not likely to be directly determined seismically; yet, seismic data reveal conditions where groundwater may be expected.

Airports: Airport runways are broad, relatively short super highways that take the hardest of transportation's hard knocks. As in motor highway construction, seismic data provide vital information in the early stages of location as well as establishing a basis for design. How most economically to determine the needed grades, where the subsurface drainage controls are, and what the character of the under-surface materials may be, are solved from seismic readings.

Dams: The seismic method today is commonplace when it comes to the selection of dam sites and in

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determining the character of the areas under the structures. Presence of large sink holes or cavernous rock, as well as determination of the location of changes in rock types are made clear through seismic means. When planning a dam site, you naturally think in terms of the seismic survey.

Bridges: Sound preliminary subsurface data are necessary to expedite the choice of type of foundation for bridges and to facilitate the foundation design. Many instances can be cited where inadequate subsurface information has resulted in costly construction delays. Various sites can be rapidly examined seismically, resulting in many economies. Seismic surveys can quickly identify the continuity and character of materials in the bearing area to enable the choice of a stable and permanent foundation for bridge structures of various types and sizes.

Tunnels: Depth of rock over a tunnel roof, the presence of shattered zones and the possibility of subterranean drainage share importance in the construction of tunnels as well as in their usefulness once they are built. Seismic data go a long way to supplement the information obtained through surface geology, adding the kind of data that provides a sound basis for planning and construction. The expense of tunnel building warrants the fullest possible information before construction begins—especially when it can be obtained at moderate cost.

Sand and Gravel: So varied are the uses of sand and gravel that their on-the-spot location is of prime importance locally. Their transmission velocities of vibrations are characteristic. Thus, from their seismic readings, loose materials can be identified. Though the quality of sand and gravel must be determined by sampling, the presence of firmly cemented gravel will be apparent from the seismic information.

Sewers: Since consistent grade is essential in sewer construction, deep cuts are frequently necessary. The seismic survey readily determines which of alternate routes provides the easiest, simplest, money-saving excavation. The ratios of rock and loose excavation can be read from seismic data. The problems of support of large sewers, and of their placement, are dependent upon the subsurface materials in which the lines are set. The seismograph can picture the problems both in depth and length.

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Removing Oil and Grease

Leonard Refineries, Inc. in Alma, Mich., is removing oil and grease from 180-200 gpm of effluent by the dissolved air flotation process. Since its installation July 11, 1954, a 500-gpm unit has been operating continuously, yielding water with an oil and grease content below 10 ppm, with an alum feed rate of 65 ppm. The plant is recovering some 30-40 gpd of oil and grease. During a 2-week test run, the Colloidair reduced the floatable oil and grease from an average of 86 ppm to 4 ppm; the sulfides from 281 ppm to 208. The pH of both influent and effluent averaged 8.3. The power costs are about $5 a day. The alum costs about $3.34 a day, or 1.25 cts. per 1,000 gal. Attention required about 1½ hr. per day.

"Improved Waste Water Clarification by Dissolved Air Flotation Unit." By C. E. Fiske and Paul Mernitz. *Public Works,* April.

Treating Chemical Wastes by Settling and Dewatering

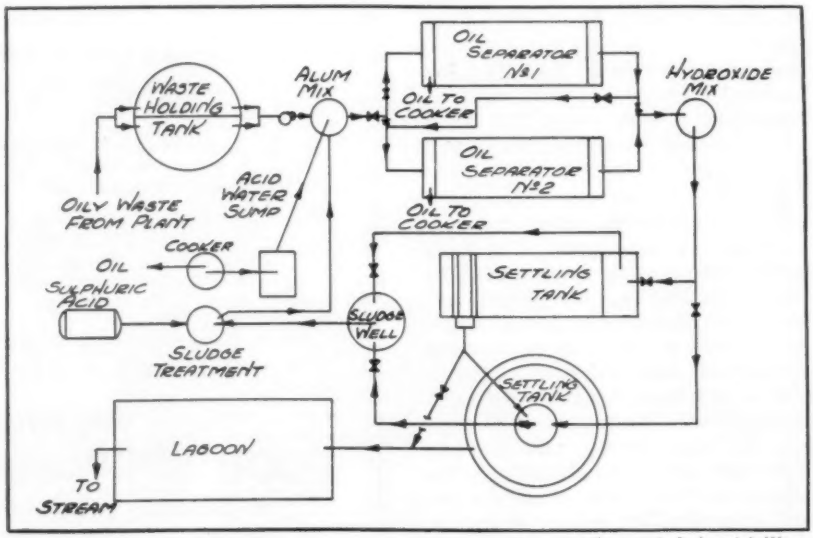
The Cincinnati Chemical Works manufactures organic dye stuffs, the effluents from which contain spent sulphuric acid. The acid quantities are not great enough and are too impure to permit economical regeneration, and are neutralized by lime. In order to meet the requirements for discharging the effluent into the municipal sewers, it is necessary to reduce the suspended solids, which range from 5,412 to 2,500 ppm, and the BOD, which ranges from 620 to 325 ppm, to maximums of 300 ppm and 240 ppm respectively. Experiments showed that the suspended solids could be removed by settling in either lagoons or concrete basins. The latter were chosen because they occupied less ground and the sludge can be moved more easily. A primary settling tank provides 4 hours detention and is equipped with continuous sludge removal mechanism. Concentration tanks receive the sludge and store it for dewatering, which is accomplished by a spring-type vacuum filter, which filters at rates as high as 50 lb. of dry solids per sq. ft. per hour, producing a cake with 65 to 68 percent moisture. The sludge cake is dumped on the company dump. This treatment does not quite reduce the BOD to the city's standard for "normal sewage", but the surcharge for excess BOD is so small that it would not be economical to provide the additional treatment necessary to remove it.

"How Sewer Surcharge Fees Were Saved by Wastes Pretreatment". By M. W. Tatlock. *Wastes Engineering,* March.

Removing Oils From Machine Shop Wastes

This paper deals briefly with the efforts of the Chevrolet Motor Div. of General Motors Corp. to reduce the oil content of waste waters at manufacturing plants and rendering them suitable for reuse. At these plants the waste waters have oil contents as high as 40,000 ppm. More than 2,000,000 gal. of oil have been reclaimed since 1950, most of which has been used as fuel oil, and about 5 percent for dust control. The treatments used involve the general principles that an emulsion of oil and water may be broken by treatment with an electrolyte and that small quantities of oil may be removed from water by treatment with a coagulating chemical. It is found that an inorganic salt is more efficient than a similar quantity of acid; and a salt, the positive ion of which is divalent or trivalent, is more efficient than one with a monovalent ion.

The simplest process used at Chevrolet is continuous treatment of segregated waste by the addition of aluminum sulfate. The oily scum is removed from a gravity-type separator and treated with sulfuric acid. For treating large quantities (10,000 gal. of waste water per hour), the waste passes through an upflow mixing tank, where it is treated with a combination of aluminum sulfate and sulfuric acid; then passes to a gravity oil separator, where the oil is skimmed off. Caustic is next added to raise the pH for optimum floc formation, the waste is mixed and passed to a sedimentation tank. The settled



Courtesy Sewage & Industrial Wastes

● **FLOW diagram showing method for improved treatment of oily wastes.**

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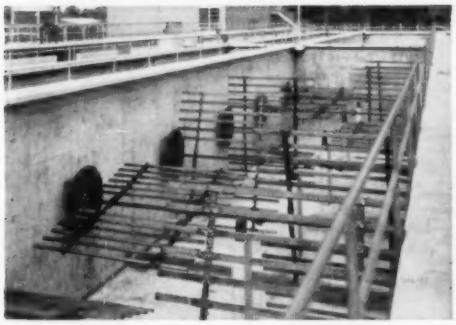

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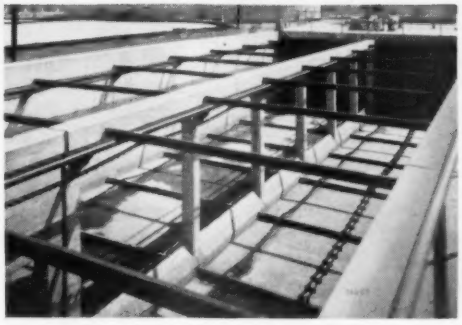

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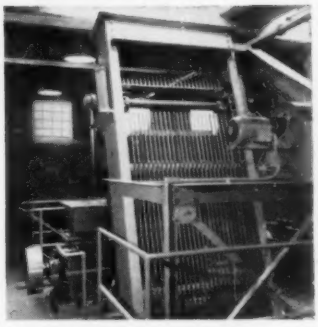

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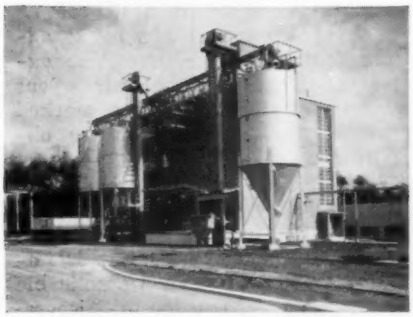

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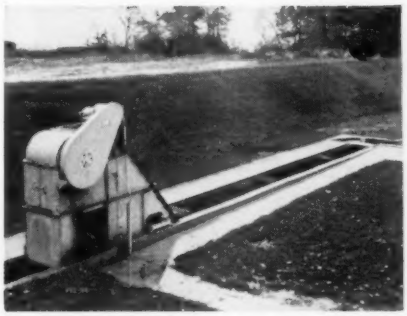

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sludge is treated with sulfuric acid. The effluent is routed to a small lagoon and thence to a storm sewer.

"Treatment of Machine Shop Wastes Containing Emulsified Oils". By C. W. Hathaway, Metallurgical Dept. Gen'l Motors Corp. *Sewage and Industrial Wastes,* February.

Ion Exchange for Electroplating Wastes

As a result of tests of ion exchange for treating electroplating wastes, the Ternstedt Div. of General Motors Corp. is constructing at Flint, Mich., a full-scale ion exchange plant for treating waters discharged from rinsing operations following chromium, nickel, and acid copper electroplating operations. Each type of rinse water is given a complete demineralization treatment by passing through a cation and anion exchanger. The effluent water can be used for a wide variety of in-plant operations. Ion exchange treatment of electroplating wastes is in its infancy, but it "appears to have an excellent opportunity to accomplish the objectives of pollution abatement, reclaiming process chemicals for further use and conserving process water".

"Operation of Ion Exchange Units for Treatment of Electroplating Wastes". By T. J. Fadgen, Chemist and Metallurgist, Gen'l Motors Corp. *Sewage and Industrial Wastes,* February.

Treating Waste Pickle Liquor by Oxidation

The A. O. Smith Corp. of Milwaukee neutralizes its waste pickle liquor with carbide lime, a by-product of the acetylene industry. To facilitate the disposal of the resulting sludge, dewatering seemed to be necessary, and a plant placed in operation in 1951 included a disc-type vacuum filter for this purpose, which produces a filter cake of 50 to 60 percent moisture. The lime slurry and waste pickle are first pumped into a reactor tank in such relative quantities as to maintain the mixture at a pH of 7.0 to 8.0; compressed air being admitted at the same time. The extent of oxidation of the ferrous ions affects filtering rates to a marked degree. The best rates were obtained when from 2 to 5 percent of the ferrous ions was oxidized to the ferric state. The fact that good filterability is obtainable at this low percentage of oxidation is important in making this a practicable and economical one for the disposal of waste pickle liquor.

"Disposal of Waste Pickle Liquor by Controlled Oxidation and Continuous Lime Treatment." By Lorenz W. Heise and Milton Johnson, A. O. Smith Corp. *Sewage and Industrial Wastes,* February.

City Treatment of Industrial Wastes

While discharging an industrial waste into a municipal sewerage system is frequently the simplest and most economical solution for an industry, the procedure is complicated by the transfer of liability for stream pollution to the city and the usual employment by the municipality of treatment processes insufficiently flexible for many types of wastes. Cities have been forced to adopt ordinances and regulations that restrict indiscriminate discharge of industrial effluents. Typical regulations limit the pH range of wastes received between 5 and 10; prohibit the discharge of many toxic wastes; exclude highly flammable substances and hot liquids; and specify maximum allowable concentrations of suspended solids and the particle size of in-

City of Winston-Salem (N.C.) sweeps downtown walks with their Tennant "75" Sweeper.

How a fast, compact TENNANT Sweeper...

sets a new standard in clean, LOW-COST sweeping

In busy downtown areas, where *clean* sweeping counts most, but is costly—a compact TENNANT Power Sweeper pays for itself fast. It not only *does the work of a crew of men;* it sets a new standard for clean work. You'll see the difference.

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It's rugged . . . compact . . . easy to use; and superbly engineered for long, dependable service.

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soluble materials. While industries may feel that the treatment burden of the city is offset by high proportionate taxes, the argument is fallacious in that no one may destroy the investment of others. Ordinances usually provide for charges to the industry based in part on waste volume, which offers incentive to the industry to reduce unnecessarily high volumes. The remedy lies in mutual understanding and cooperation between the city and industry, with the latter striving to discharge a treatable waste and accepting a proportionate share of the cost of treatment. Municipal officials should assist industries in the solution of their waste treatment problems. Among procedures which can be followed generally by industries to minimize the problem are: isolation and separate disposal of unacceptable wastes or storing them for discharge gradually in diluted form, preventing wastage of raw materials within the plant, and recirculation or re-use of such materials.

"IEC Production Forum: Industrial Wastes." By Sheppard T. Powell, *Industrial and Engineering Chemistry*, March.

Atmospheric Pollution and Public Health

The effects of exposures to a considerable number of relatively pure toxicants have been studied intensively by medical and industrial hygienists for many years. Threshold limit values of maximum allowable concentrations of a long list of gases, vapors, mineral and other dusts, fumes and mists to which an industrial worker can be exposed for eight hours daily for an indefinite period without injury or occupational disease have been accepted. Each year these values are reviewed and new substances added by the American Conference of Governmental Industrial Hygienists and other interested organizations.

Such data provide only limited help in attempts to extend the information to air pollution problems in relation to community health. The maximum allowable concentration values are far higher than the concentrations occurring in outside atmosphere, and they are not applicable to those persons with impaired health, the very young, and the aged. Also, in the atmosphere of communities, a great number and variety of contaminants ranging from known compounds to those of unknown or indefinite composition are found. Further complications arise by the reactions of

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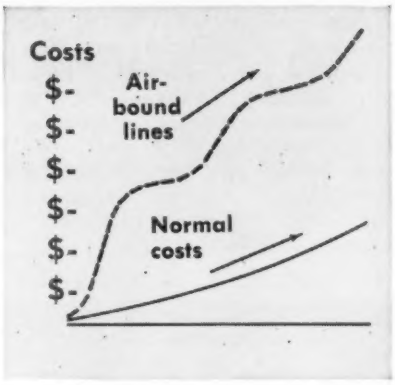
Simplex Air Release Valves end these troubles. They vent air automatically to eliminate binding, increase efficiency, cut pumping costs. Simple, rugged 2" size, for up to 250 psi., costs you little, quickly pays for itself! BULLETIN 1204



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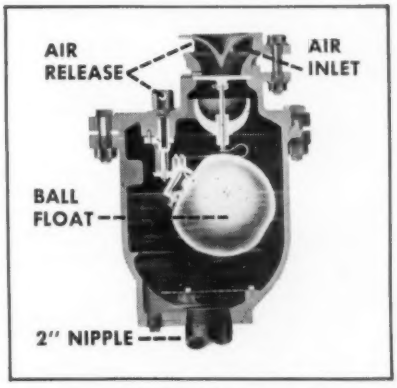

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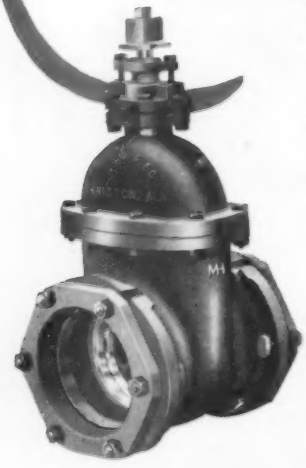
photochemical and catalytic nature which can occur between gases and particulate matter after liberation to the air.

The acute effects of various atmospheric contaminants on man have been demonstrated in several air pollution disasters including that at Donora, Pennsylvania and the the London fog of December, 1952. In no instance, however, did the investigations on the environmental and medical aspects of these disasters provide an answer to the question of the casual agent responsible for the severe respiratory symptoms and deaths.

Progress in evaluating the extent of chronic effects or in providing the existence of this type of injury to health in industrial communities has been virtually nil.

The Detroit River area health study will represent a scientific attempt to determine the effects of prolonged exposure to such contaminants as occur in the atmosphere of a highly industrialized region. Detroit and Windsor have been chosen for study with two other towns about forty miles outside the area for controls. Sampling stations have been established and measurements taken. Areas have been selected containing well defined population groups matched according to socioeconomic status and other factors so far as possible. Initial study will include 500 households in Detroit and 600 on the Canadian side. Trained enumerators were selected for regular visits at two-week intervals to collect the required data on sickness experience. The health study was commenced in the late summer of 1953 and has been underway since that date.

"Atmospheric Pollution: A Growing Problem in Public Health," By Morris Katz, Ph.D. *American Journal of Public Health* March.



Research . . . engineering . . . mechanical tests . . . laboratory tests . . . discussions . . . arguments . . . flow tests . . . operating tests . . . field tests . . . . . . ideas, theories, plans . . . more research . . . more drawings . . . more tests . . . on and on and on over the years!

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Metalworking Wastes Treated in Lagoons

The Dana Corp., in Fort Wayne, Ind., from 1946 to 1951 treated its metalworking wastes in lagoons. The operation had been so satisfactory than when a new plant was constructed in 1951, they decided to treat its wastes also in lagoons, modifying the method to take advantage of their experience with the old. The process wastes include soaps and alkaline cleaners; acid cleaners; oils, both mineral and emulsified; solvents, emulsions; paint; boiler compound; other acid wastes; and plating wastes. The part of the property used for lagoons is about 30 ft. lower than that where the buildings are located, so that the wastes flow by gravity through a series of four lagoons. The first basin gives a detention time of less than 3 days. From this it flows with a fall into a second basin of the same size; and from this into a third basin giving about 96 hr. capacity and an area slightly less than an acre. The fourth basin has an area of about 11 acres and a theoretical detention time of 40 days. At each drop between basins the flow is aerated, oxygen is absorbed by the 11-acre surface and as the final effluent leaves over a weir. This aeration is an important feature of the treatment. The first basin reduces the oil content from an average of 2,543 ppm to 92.2 ppm; the suspended solids from 1,484 ppm to 79; and the BOD from 202 to 52 ppm. As the flow passes through the other three basins, the oil content drops progressively to 45.1 ppm, 30.4 and 11.5; the BOD to 33 19.1 and 4.2. The final basin contains DO which has shown a minimum of 6.4 ppm. The stream which receives the effluent sometimes has a DO as low as 0.5 ppm, and is so improved by the effluent as to support fish life below the outlet. Slugs

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of wastes sometimes are discharged but lose their identity before reaching the third basin.

"Lagoons For Treating Metalworking Wastes". By Charles R. Griffith, of Dana Corp. *Sewage and Industrial Wastes*, February.

• • •

Soil Compaction and the Performance of Compaction Equipment

THE results of recent research work on soil compaction carried out at the British Road Research Laboratory, Harmondsworth, are discussed and relevant data described in a previous paper are briefly recapitulated. Consideration is given to (1) factors affecting the selection of the moisture content at which to compact soils in earthwork construction in the British Isles, (2) the state of compaction required in road embankments and subgrades, (3) the performance of plant used for compacting soil, and (4) the specification and control of soil compaction. It is suggested that soils should be compacted at their natural moisture content measured below the top 3 to 4 ft. of soil usually affected by weather conditions. The state of compaction of a number of existing embankments was measured, and the results showed that the main bulk of the fill need not usually be compacted to a higher density than that corresponding to 10 percent of air voids. A higher state of compaction may be needed in the top 1 to 2 ft. of fill to prevent slow settlement under traffic and vibration.

The following soils were used in the tests to determine the performance of plant: A heavy clay, a silty clay, a sandy clay, a sand, and a gravel-sand-clay. Fourteen types of compaction plant were studied, including a smooth-wheeled roller, a pneumatic-tired roller, sheepsfoot rollers, rammers, vibrating smooth-wheeled rollers and plate vibrators. An 8-ton smooth-wheeled roller produced very high states of compaction with all the soils tested. A 12-ton pneumatic-tired roller was equally satisfactory in compacting cohesive soil but its performance was poorer on granular soils. The rammers furnished high states of compaction with all the soils but outputs were lower than with the other plant. Vibrating-roller and vibrating-plate compactors achieved best results on granular soils but were less satisfactory on cohesive soils. Details are given of outputs of the machines and costs per cu.

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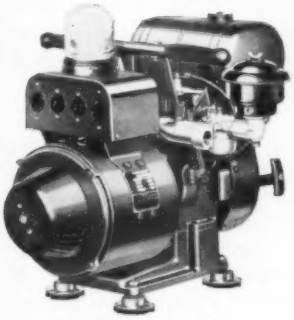

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Portable Kohler Electric Plants save man hours in maintenance and repair of sewage and water pipes and streets. Can be taken instantly where needed for floodlights, power tools. Rubber-tired hand cart available . . . Kohler stand-by plants, sizes 1000 watts to 35 KW, keep essential equipment running in sewage treatment and water filtration plants when storms or accidents cut off central station power. Install *before* the emergency. Write for folder C-15.

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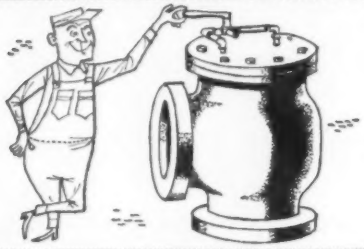

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yd. for good compaction. It is considered that the method of specifying the state of compaction required in earthworks in terms of maximum dry density obtained in laboratory compaction tests is not satisfactory, and an alternative method of specification in terms of a maximum percentage of air voids in the soil is suggested.

W. E. Lewis: Department of Scientific and Industrial Research, Road Research Technical Paper No. 33; London, 1954 (H. M. Stationery Office), 9½ in. by 6 in., pp. vi +46, fig. 18, tab. 9, plates 8, 3s.

• • •

Sanitary Engineer Wanted

A sanitary engineer is wanted to work for an established engineering organization, representing it in a large southern resort city. The work is in connection with operation and expansion of the municipal water and sewerage systems. Age limits are 35 to 45; salary is $9,000, plus or minus, depending on background and experience. Must be an engineering graduate. Write Box Z5, Public Works, which will forward all applications. Snapshot of applicant is desirable along with letter.

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Industrial Waste Engineer

A large city in the southwest desires the services of an engineer skilled in industrial waste. Salary range is $411 to $548. Duties will include supervision of the industrial waste program beginning with a survey of all industries in the city, followed by preparation of a control program and suitable industrial waste control ordinance. Equivalent of a degree in chemical engineering and five years of experience in work involving chemical engineering and industrial waste treatment are required. Good opportunity for promotion. Write Box GD5, Public Works, which will forward all applications.

• • •

Well Points

(*Continued from page* 84)

of clay or rock, some special steps need to be taken in setting the well-points to insure complete dewatering of the last one or two feet of the sand. With the well-points set just above the impervious bed, the water level can only be pulled down to the depth where air may enter the well screen and break suction. This may be at the top of the screen

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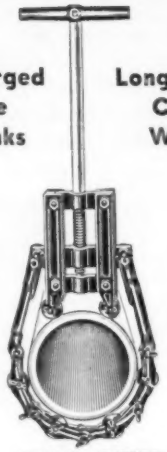

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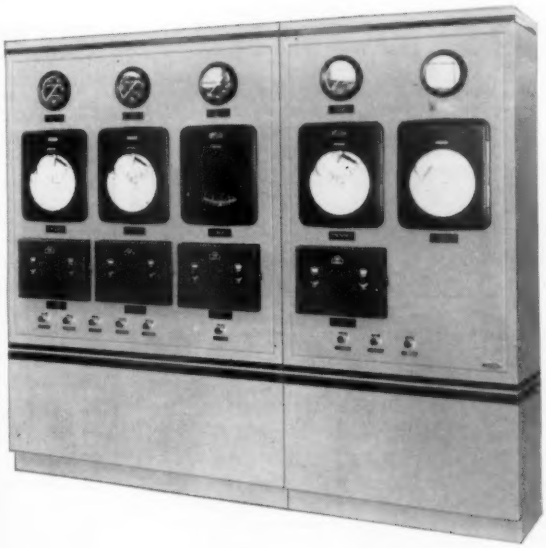
Supt. Charles A. Crane turns "finger-tip" control selector switch on one of four Foxboro Master Operating Tables at Fairfield plant. Using switch, he can shut off influent or by-pass effluent to waste; start filtration or backwashing at pre-set rates. In addition, he can re-set rates at any time, without moving from table. Operating table is integrated with automatic control cabinet (right) to provide high versatility . . . maximum ease of operation.



Five instruments across center, l. to r., are recording and integrating — or controlling — influent and effluent flows, clearwell level, backwash rate, and effluent temperature. Timers (beneath) operate with influent flow recorder to proportion chemicals to influent.

Clean-cut, all-pneumatic operation of Foxboro Automatic Control for Rapid Sand Filters pays off in lowest cost installation, minimum maintenance, and greatest convenience. It's unaffected by backwash and sand . . . requires no drum, pulley, or cable servicing. Rugged d/p Cell Transmitters handle loss-of-head and filter rate measurements. Long-life, rubber-lined butterfly valves assure positive shut-off action.

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or, if the well-points are provided with center drop tubes, it may be about a foot above the bottom of the sand.

The well-points can be set low enough to dewater clear to the bottom by sand-packing them in larger diameter holes cut into the impervious bottom to a depth of two or three feet. To do this, a six-inch or eight-inch temporary casing is jetted down from the ground surface to the required depth, the well-point and riser assembly is centered inside the larger pipe and the annular space around the well-point and riser is filled with clean, coarse sand. As the sand envelope is placed, the temporary casing is withdrawn. If the bottom is rock or hard shale that cannot be penetrated by jetting, it may be necessary to use a well drilling machine to cut the sumps into which the well-points are to be sand-packed. Whether or not the cost of cutting the sumps in a rock bottom may be justified on a particular job must be analyzed for each case.

The presence of tight layers of silt or clay at various depths in the saturated soil complicates the design of the well-point system since they prevent vertical drainage of the sand lying above them. Even though these layers may be as thin as an inch or so, they are practically impervious. Successful dewatering of a stratified formation requires provision for draining each stratum of sand as a separate formation. We have already suggested that a two or three-stage system may be needed for this purpose, with the well-points in each group installed at the bottom of each group installed at the bottom of each respective layer of sand.

Where conditions are not too troublesome, vertical drainage channels that pierce the impervious strata can be provided by sand-packing each well-point and riser pipe in eight-inch to twelve-inch diameter holes. In the manner like that already described, a large temporary casing is jetted down through all the strata, the well-point is centered in it and the annular space filled with clean coarse sand up to the static water level. The outer casing is pulled up as the sand-pack is put in. This sand envelope will sometimes provide the vertical drainage desired, although it does not always work for the reason that a skin of silt and clay may be formed on the wall of the large hole by the "trowelling" action of the temporary casing as it is withdrawn. This slick or skin cannot be removed above

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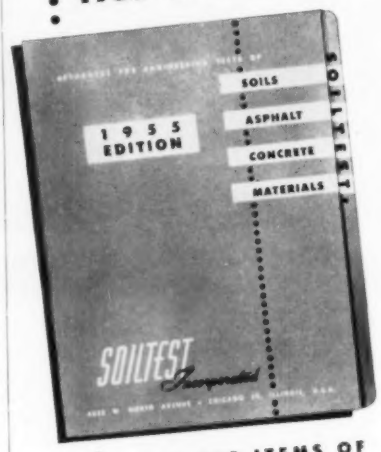

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the top of the well-point since there is no way to get any development or washing action above the screen that will remove anything that is sandwiched between the natural formation and the outer base of the sand packing.

To determine the best depths of setting where stratification is apt to be a problem, it is worthwhile to put down a few test wells and pump them experimentally. The yield of the water-bearing formation should be checked at different elevations by successively setting and pumping the well-point in each test well at various depths. The well-point can be set to maximum depth first, then pulled up a few feet for a second test. In making the pumping test a vacuum gage should be used on the intake of the pump to measure the suction head. The rate of pumpage is measured by pumping into a container of known volume and timing the filling of it.

Features of Well-Points

The reasons for the high efficiency of continuous-slot well-points have already been pointed out. These screens, made just like the well screens used in large permanent wells, are fabricated by winding a special-shaped wire around a skeleton of longitudinal rods. Each point of contact of the outer wires and rods is welded. The resulting screen is a one-piece unit, strong and rugged, but with a high percentage of open area. It will stand a lot of abuse, a most important consideration, since dewatering well-points are installed and removed repeatedly.

Both the drive-type and the jetting-type of continuous-slot well-points are used for dewatering work. Although designed for driving, drive points are also frequently installed by first washing down a hole with a separate jetting pipe and then dropping the well-point and riser pipe in the hole which will be held open temporarily by the return flow of the jetting stream. Driving the points is less favored because it is slower.

Where the screens are to be sand-packed in larger holes for the reasons we have outlined above, the drive-type should be used for economy. Drive points are available with center drop tubes if desired.

The jetting-type well points equipped with self-closing bottoms are sunk into place, with riser pipe attached, by using a pump that will deliver 60 to 100 gpm at a pressure of at least 80 psi. A continuous-slot well-point with self-closing bottom can be used. Or Figure 5

the same point can be fitted with a center drop tube.

The center drop tube serves two useful purposes but it also has some disadvantages. It permits jetting the well-point down without running a temporary jetting pipe inside the riser and screen. Secondly, the well-point with the drop tube will permit the water in the adjacent formation to be pulled down to the level of the bottom of the tube before breaking suction. This is obviously desirable where the well-points must be set above an impervious layer.

One disadvantage of the center drop tube is that it causes additional head loss in the well-point. The water entering the screen must flow down outside the tube, turn 180° to enter the tube and then flow up through the reduced diameter. Another difficulty is that the presence of the tube prevents any effective development of the formation around the well screen. Where the tube is not used, the development takes place when the points are being pumped and cleaned out preparatory to putting them into operation. This development plays an important role in improving the operating efficiency of each well-point in the system.

Draining Very Fine Soils

Since we have already spoken of sand-packing of well-points in some special situations, it should be pointed out also that sand-packing is of advantage in draining very fine sand of grain size barely larger than silt. The envelope of coarse sand around each screen permits drainage while preventing movement of the fine material into the wells with the water. Through research and experiment our engineering department has worked out the proper gradings of material to use for sand-packing screen in various types of formations and is glad to make recommendations on specific jobs.

The yield from such fine soil will always be low—so low in fact as to raise the question of whether practical dewatering can be achieved. Experience shows, however, that removal of even a small volume of water will stabilize the material in many cases. With the water moving away from the open slopes of the excavation under the constant pull of the well-point system, the surface tension of the pore water in the capillary openings in the soil is a significant factor in stabilizing the banks in addition to the actual reduction in water content of the soil.

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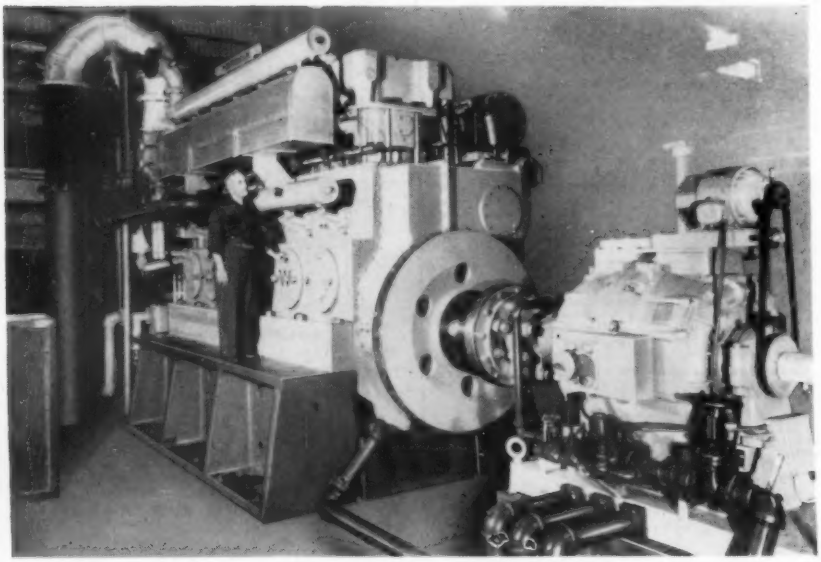
Worthington Has a New Line of Power Engines

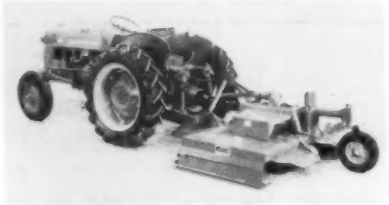


The new Worthington power engines, the SW 14 line, are high pressure turbo-supercharged, four-cycle, rated from 1360 to 5000 hp at 450 rpm. Largest of the new line is a 16-cylinder V-engine which, it is said, will develop twice as much power as present engines of the same weight and dimensions. The SW 14 line was developed as a result of more than ten years' study of market requirements for both direct drive and electric power generation, particularly for applications in private and public electric central stations; water works; sewage disposal plants; irrigation and drainage projects; industrial power plants; dredges; radio and radar.

The tri-power arrangements permit use of the new engines as oil diesel, dual fuel diesel, or spark ignition gas. One of the unique features is the interchangeability of major parts between the in-line and the V-engines, such as cylinders, heads, rods, pistons, bearings, fuel injection equipment, etc. When an in-line engine is installed, with a view toward adding a V-engine at a later date, the user is not confronted with stocking many different spare parts to service both engines during periodic overhaul. Other major features are described in literature available from Worthington Corp., Harrison, N. J., or by circling No. **5-1** on the coupon.

Two Wood's Rotary Mowers and Shredders

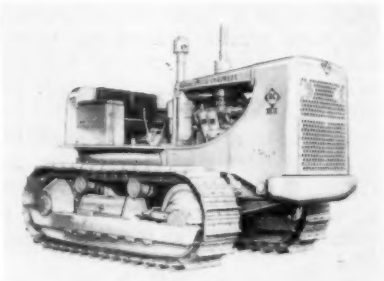
Two new units are announced by Wood Bros. These rotary mowers-shredders can be adjusted closely to cut as desired. They have special shielding for mowing without clearing away rocks and refuse first. They can be maneuvered close to buildings or fences and will handle rough and tangled weed growth. The M80 cuts to a width of 80 inches and can be mounted on a variety of tractors including International, Oliver, Ford and Deere. The M114 cuts 114 ins. wide and is adapted for hard and heavy work. Catalogs are available on both units. Write to Wood Bros. Mfg. Co., Oregon, Ill., or circle No. **5-2** on the coupon.



Rotary mower and shredder, one of two recent models by Wood Brothers.

Allis-Chalmers HD-16 Diesel Crawler Tractor

Allis-Chalmers announces its second completely new crawler tractor this year, the 31,500-lb. HD-16, available with torque converter drive and standard transmission. Its engine develops 150 hp at 1800 rpm with torque converter and 140 hp at 1600 rpm with standard transmission. Maximum drawbar pull of 60,000 lbs. is obtained with torque converter drive. The standard transmission tractor has a maximum drawbar pull of 31,700 lbs. at rated engine speed. Under overload, the engine torque increases, thus resulting in additional drawbar pulls at reduced travel speed. These high drawbar pulls take full advantage of the additional weight and traction available when mounted equipment such as dozers, shovels and other equipment are used.



New A-C diesel crawler tractor has 150 hp, is easy and fast to operate.

Comfort, ease of operation, and visibility for the operator, essential features of the HD-16, are provided

by the new adjustable foam-rubber seat; finger-tip control with hydraulic steering and time-saving shift pattern; and 24-volt direct electric starting. Standard equipment includes hydraulic steering controls. A new line of matched equipment—dozers, shovels, scrapers, power control units, and side-boom—is designed especially for the HD-16. The new "Wrap-Around" radiator guard reduces the cost of the tractor-dozer packages because the hydraulic rams or cable-lift sheaves mount directly on it, thus eliminating the need for a separate dozer lift frame. For more data, circle No. **5-3** on the coupon.

Pump for Extreme Drainage Problems

The Weil Pump Company have developed a new pump to handle extreme drainage problems which occur in highway underpasses and other similar locations where heavy rainfall causes flash floods. The

Pump for extreme drainage conditions handles up to 2,000 gph.

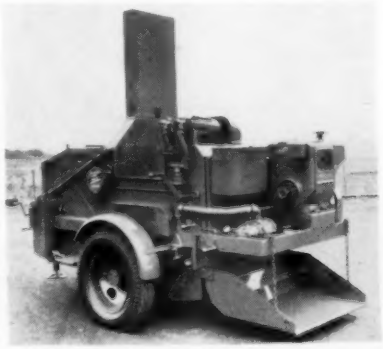
pump is a heavy duty screenless type, equipped with a non-clog impeller. The motor is mounted directly on top of the pump casing. The entire unit is designed for submerged operation, and for continuous operation during flood periods. The operating parts are not subject to corrosion, deterioration, or injury when standing idle—regardless of weather conditions. The unit is self-contained with sealed bearings. The special lubricant used requires change only once in every five years. The pumps will handle solids up to 3½ ins. diameter. The pumps can be installed in pits under the roadway or along the right of way. No pump house is required. The only protective housing needed is for the control center and power supply. Control systems are available with no moving parts in the pump pits. Discharge capacities are: 4-in. to 400 gpm; 5-in. to 1250 gpm; 6-in. to 2000 gpm. More from Weil Pump Co., 1526 A No. Fremont St., Chicago, Ill., or circle No. **5-4** on the coupon.

Polyvinyl Plastic 3-Rib Cellular Waterstop

A new 3-rib cellular waterstop keeps joints watertight in spite of differential movement or straight separation. Three cells, built into the waterstop, compensate for both vertical and horizontal joint separation, such as those experienced with slabs placed on ground where uneven settlement may be unavoidable. The cellular waterstop is extruded from vinyl plastic, requires no form splitting, and is readily spliced in the field with a heated knife or soldering iron. It is made 4½ inches wide and 2¼ inches deep, with cells ½-inch deep; it comes in 25-foot lengths. Weight approximates 2 pounds per lineal foot. For more data write Water Seals, Inc., 9 South Clinton St., Chicago 6, Ill., or circle No. **5-5** on the coupon.

Littleford Self-Contained Bituminous Mixer

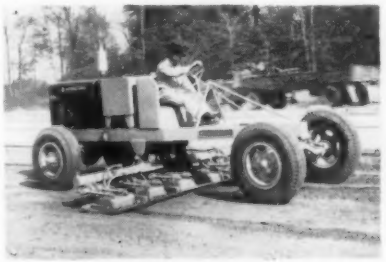
This "Trail-O-Patcher" produces up to 7 tons of hot mix or 12 tons of cold mix per hour. It has its own bitumen metering system and its own aggregate drying compartment. Batches are 7 cu. ft. There is a no-drip drawoff for filling pouring pots. The exhaust stack is hinged to permit storage in low garages. Hand spray attachment is optional. Specially designed for patching, maintenance and small resurfacing jobs. More from Littleford Bros., Inc., 452 E. Pearl St., Cincinnati 2, Ohio, or circle No. **5-6** on the coupon.



This mixer produces 7 to 12 tons per hour of asphaltic mixtures.

Bases Are Laid and Compacted to 12 ins. Thick in One Pass

A new vibratory compactor for paving operations has been developed by the Roadequip Manufacturing Co., RD # 2 Willoughby, Ohio. This machine enables a fast uniform compaction to specified density on macadam base courses, gravel subbases and soil cement bases. The penetrating vibration of the six individual shoes makes it feasible to lay and compact bases up to 12 inches thick in one course. Considerable saving is made in spreading and shaping time over



Savings are made in spreading and compacting time with this machine.

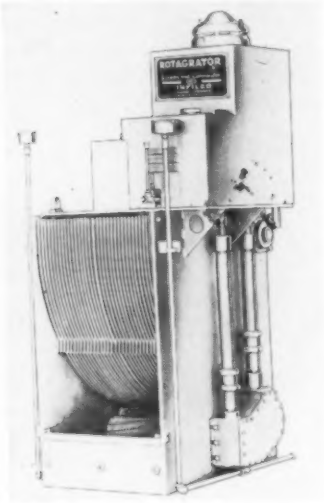
the conventional multiple layer method. The vibrator also "runs in" screenings to the full depth of macadam bases, even ahead of the vibrating shoes. Able to compact equally well going forward or reverse, this machine eliminates the need for turning around. Large, lightly loaded tires prevent disturbing the spread before the shoes have compacted it. More from Roadequip Mfg. Co., R. D. #2, Willoughby, Ohio, or circle No. **5-7** on the coupon.

Twin Diaphragms for Faster Pumping

A new 4-in. diaphragm pump combines two single units to double the conventional pumping capacity. The same ratings applied to the single valve types carry over to the new line of double pumps which now deliver up to 12,000 gph at 10-foot suction lift. Air cooled engines transmit power through a fully enclosed, double-row roller chain which serves to synchronize the two strokes at 90° intervals. Also available are gear head electric motors. The 12,000 gph unit is mounted on a truck for towing. New bulletin 55DP may be obtained direct from Rice Pump & Machine Company or by circling No. **5-8** on the coupon.

Screen and Comminutor For Treating Coarse Sewage is Available

Development of a new unit for screening and comminuting rags, cans, rubber products, glass, rope, wood and all coarse sewage materials has been announced by Infilco Inc. of Tucson, Arizona. The "Rotagrator" screen and comminutor is designed for flows ranging



This comminuting screen handles flows from 1900 to 50,000 GPM.

from 1900 to 50,000 gpm. The unit screens and comminutes materials without rejection or removal from the flow. It functions at low head loss, holding solids upstream until they are comminuted to a size permitting passage downstream. For additional information, write Infilco Inc., 921 South Campbell Ave., Tucson, Arizona, or circle No. **5-9** on the coupon.

Proportioning Pumps of Wide Range Capacity

A patented mechanical link for the adjustment of piston stroke length and, hence, pump capacity permits exceedingly accurate metering in relation to temperature, flow, pH, liquid level, pressure, conductivity or any other meterable factor. Philatrol-equipped pumps are said to operate within an accuracy range of 0.5 percent over a range from a few cc per hour to several gallons per minute. Uni-Feeders are available with capacities of 0.000093 gpm to 27 gpm. More from Philadelphia Pump & Machinery Co., 1513 Race St., Philadelphia, Pa., or circle No. **5-10** on the coupon.

Makes a roadside mower out of your motor grader; attachment is simple.

Hydraulic Mower Attaches to AC Motor Grader

This fully hydraulic mower can be attached to or removed from the AC model "D" motor grader in a very few minutes, using only 4 bolts. Drive is by hydraulic pump on the grader. Operation is from 45° below horizontal to full upright position. All controls are operated from the cab and change from mowing to grading is made by movement of a single lever. More from Triumph Machinery Co., Hackettstown, N. J., from any AC distributor or by circling No. **5-11** on the coupon.

New-Type Vibrator for Pavements and Airports

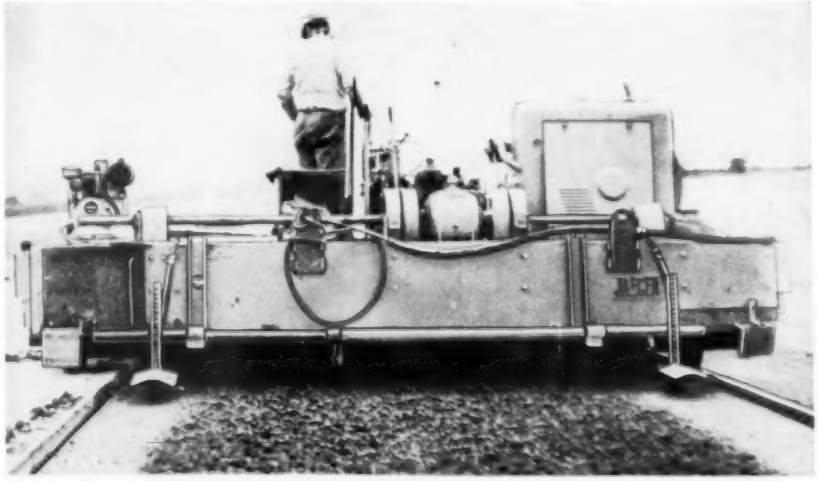
A new "Hi-lectric" side form vibrator attachment, for use on highway, airport and municipal concrete pavement construction projects, is announced by the Maginniss Power Tool Co., Mansfield, Ohio. The new lightweight unit is designed for mounting directly on 12 or 24-ft. Jaeger or Blaw Knox concrete spreaders and 12 or 24-ft. Jaeger, Blaw Knox or Heltzel finishers. It is also adaptable to telescoping type finishers. Vibrators can be mounted as much as 15 inches in from the side forms and still vibrate concrete effectively at the forms, leaving it free from honeycomb, the manufacturer says. Side form vibration is supplied by two Maginniss Hi-lectric motor-in-head concrete vibrators. Each vibrator head is capable of delivering up to 10,500 vibrations per minute. A Maginniss gasoline engine-driven generator supplies current to power the vibrators, as well as floodlights and maintenance tools when needed. Vibration frequency can be varied by adjusting engine speed. Use of this vibrator eliminates hand spading or manual spud vibration of side forms. More from the manufacturer or circle No. **5-12** on the coupon.

Self-Propelled 125 cfm Air Compressor

A new self-propelled air compressor, the "Pneumatractor", is announced by Schramm. This is the same 125 cfm engine-compressor power plant used previously in other units, but built into a self-propelled tractor unit. More from Schramm, Inc., West Chester, Pa., or circle No. **5-13** on the coupon.

Revitalizing Road Signs and Markings

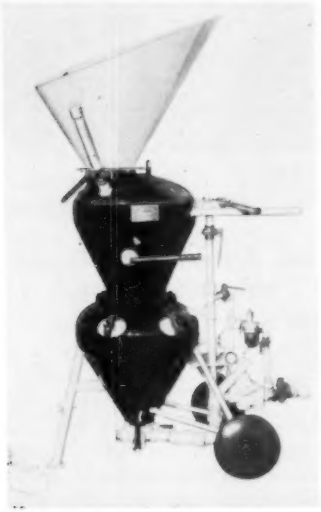
A kit has been developed by Prismo which permits applying a brilliant, moisture-proof coating to road signs and markings damaged by winter or wear. The coating is durable (claimed to last 5 to 7 years), and reflective. More from Prismo Safety Corp., Huntingdon, Pa., or circle No. **5-14** on the coupon.



Designed to mount on standard spreaders and finishers, this electric vibrator eliminates hand spading or manual spud vibration of the side forms of pavements.

Versatile "Gun" for Placing Concrete

The Blastcrete gun places 1 to 8 cu. yd. of concrete per hour or about 2 cu. yd. per hour per 100

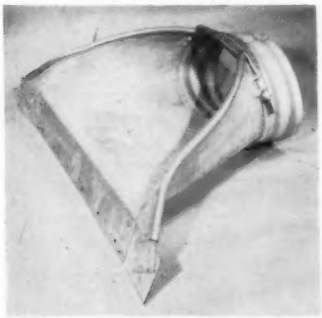


Concrete gun for "shooting" concrete into place on all kinds of public works.

CFM of air. This gun handles material of high moisture content; rebounds are immediately reusable. The flow of material is easily adjustable while the gun is in operation. Design meets ASME requirements as well as all insurance requirements on pressure vessels. Designed for low-cost work on many types of public works, full information is available from Blastcrete Equipment Co., 11154 Santa Monica Blvd., Los Angeles 25, Calif., or circle No. **5-15** on the coupon.

End Connection for Corrugated Culverts

A new type of "end section" for corrugated metal structures is said to cut both material and installation costs. It is an alternate type of connection for use in 30″ and 36″ pipe, and pipe-arches from 18″ x 11″ to 58″ x 36″ inclusive. On pipe from



End section for use with corrugated culverts reduces erosion at the outlet.

12″ to 24″ inclusive, the full circumferential rod and lug are used. On 42″ and 48″ pipe and the two largest pipe-arches—65″ x 40″ and 72″ x 44″—end sections are fabricated with a riveted-on connector section and joined to the culvert barrel with a standard band coupler. According to Armco, the new type of connection provides ample strength and reduces the cost because of material and fabricating savings. More from Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or circle No. **5-16** on the coupon.

Bantam Sized Air Hammer and Sand Blaster

This little air hammer, operated from a Wald striping machine as a source of power, can be used to scale paint, peen, tamp, cut sheet metal and do a variety of chiseling and routing jobs. The same type of kit is the sand blast gun which, using a quart jar or other small con-

All sorts of small-size jobs can be done with this air hammer and sand gun.

tainer, will remove rust, paint or dirt and do other small jobs. More from Wald Industries, Huntingdon, Pa., or circle No. **5-17** on the coupon.

Flexible Collapsible Air Diffuser

A new flexible, collapsible diffuser for introducing air or other gas into a liquid to produce agitation or to effect absorption or desorption has been developed by Infilco. The "Colaflex" diffuser maintains practically constant permeability for fine diffusion of air or gas in sewage, industrial waste and waste treatment. The flexible fabric diffuser element is easily cleaned merely by operating a three-way valve manually or automatically to cut off the gas supply and vent the diffuser to the atmosphere. For descriptive Bulletin 6530-B, write Infilco Inc., 921 South Campbell Ave., Tucson, Arizona, or circle No. **5-18** on the coupon.

Dodson's Digest

How Douglas Sanders helped me research a dust problem

Got a phone call the other day from Douglas Sanders. Douglas is a county highway engineer upstate, and he was in town attending a convention.

"Say, Dod," Douglas said, practically yelling, "you've got to meet me downtown right away!"

"What's up, Doug?" I asked, alarmed.

"Got two tickets to the opening-day baseball game, and you're elected to..."

"Wait a minute," I broke in. "I'm pretty busy. Working on some Calcium Chloride data to tie in with President Eisenhower's 25-billion-dollar highway-construction program. I don't think that . . . "

"A fine thing," Douglas interrupted. "Here I am with dusty-road problems coming up, and *you're* up on 'cloud seven,' somewhere, with billion-dollar highway projects."

"Hold on, Douglas," I laughed. "There's still enough Calcium Chloride for everybody. And it's just what you need to eliminate dust from gravel roads. What's more, Calcium Chloride more than pays for itself by keeping the road materials firmly bound together . . . reduces loss of aggregate. You'll need fewer bladings, and . . . "

"*And* I suppose you're going to tell me that Calcium Chloride applications provide a better base for future hard surfacing," Douglas added.

"Sa-a-y! What are you trying to pull?"

"Your leg, Dod," Douglas said, chuckling. "Fact is, I've already ordered my Calcium Chloride! Just trying to get your mind off those figures. Better hurry though, Dod. The game starts in half an hour. Meet me at the stadium gate?"

"Okay, Doug," I said, "but remember: it's strictly for business research."

"How's that?" Douglas asked, surprised.

"Research," I said, "on how ball parks can use Calcium Chloride to keep down dust in the infield . . . "

— L. D. DODSON

P.S. — Our leaflet, "Wyandotte Calcium Chloride for Dustproofing," lists other advantages, tells how much Calcium Chloride is used on many surfaces. If you'd like a free copy, just drop me a line. *Wyandotte Chemicals Corp., Wyandotte, Mich. Offices in principal cities.*

Wyandotte CHEMICALS

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CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

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Qualified city manager wanted for progressive city of 2500. Must have at least five years experience. Stigler is located in East Central Oklahoma. Has recently completed a $150,000.00 filtration treatment plant and water improvement program.

Some knowledge of asphalt surfacing and maintenance required as we have a paving program underway. Write giving full information about your qualifications.

Write to:

MAYOR E. C. HOLLEY
STIGLER,
OKLAHOMA

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Supt. Public Works, Supt. Water Dept. and/or Sewage Depts. Graduate Engineer, 20 years experience in Municipal and Public Utility operation, maintenance, planning and construction. Married, wishes permanent location. Available immediately.

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For leading Eastern manufacturer of nationally advertised line of plug, relief and high pressure service valves, meter connections, pipe tapping machine, etc., to contact any one or all of the following: gas utilities, water works, plumbing, heating and industrial supply houses. Straight commission. Partially established, protected, exclusive territory open.

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W. S. DARLEY & CO., Chicago 12

These tracks will give your truck the traction it needs for mud and sand.

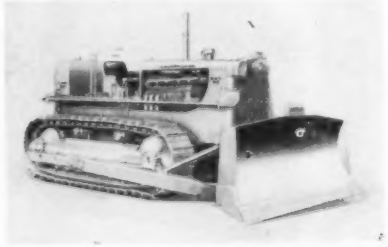
Truck Crawler-Type Tracks for Heavy Going

These truck tracks fit most tires, are easy to mount, give up to 500 percent greater flotation, and are quickly and easily adjusted to various size tires and road conditions. They come in standard tracks of 15 inches for single and tandem axles. Heavy duty 18-inch tracks are also available for many larger size tires. More from P & G Supply Co., 2262 N. Albina Street, Portland 12, Ore., or circle No. **5-19** on the coupon.

New Caterpillar D8 Tractor

A new D8 tractor—in two models—has been introduced by Caterpillar Tractor Co. The two D8 models have different drives—a torque converter (Series D) and a direct drive (Series E)—making this earth-moving workhorse even more versatile on construction and maintenance jobs anywhere. Matching attachments are available for the new tractor. These include the rear-mounted double drum and the front, single drum. New, larger bulldozers with six-part lines for greater lifting power have been designed for this tractor. In addition, all of the equipment for the former D8 is adaptable for use with the Series D and Series E units.

With a three-stage 5:1 torque converter, the D8 Series D has speeds up to 7.4 mph through a constant mesh transmission which



Another new Caterpillar crawler tractor, the new D8, has many attachments specially designed for it.

has three speeds forward and three in reverse. The direct drive has five forward speeds and three in reverse. Speeds range from 1.5 to 5.2 with the standard transmission, but optional transmissions offer speeds as low as 1.4 mph and as high as 7.2 mph. With the standard transmission on the D8 Series E, the rated drawbar pull is 39,150 pounds. This is increased to 45,020 pounds under proper traction and weight conditions. Optional transmissions will give still higher drawbar pulls. The new engine for the D8 has 191 horsepower at 1200 rpm. The drawbar horsepower is 155. Full information is available from any Caterpillar dealer, from Caterpillar Tractor Co., Peoria, Ill., or by circling No. **5-20** on the coupon.

Ripper for Motor Grader Moldboard

A special ripping attachment designed to fit a motor grader moldboard is announced by Hensley. This ripper is especially useful for backsloping, ditching, working on shoulders and banks, and for other areas not easily accessible to the standard scarifier block. With this patented ripper, it is possible to rip road shoulders with all six wheels on the ground, thereby utilizing the full motor power of the grader. The Hensley ripper fits all motor graders and most small dozers with moldboards 18-in. to 24-in. in height. Ripping depths are 7, 13 and 17 ins. More from the Hensley Equipment Company, Inc., 800 Peralta Ave., San Leandro, Calif., or circle No. **5-21** on the coupon.

Rubber Base Swimming Pool Paint

Longer lasting fine appearance, improved protection and sanitation for concrete or cement swimming and wading pools is reported by Tropical Paint Company, in announcing their new rubber-base pool paint. The longer lasting "fresh" appearance is said to come from coloring pigments that are "as near non-fading as can be made," and there is no noticeable change in shade after long exposure to sunlight. The paint is available in green and blue shades as well as white. Improved protection is claimed from the concrete penetrating qualities of the new paint. It will not support mold or mildew, which improves sanitation when the pool is either full and empty; it is also highly resistant to chlorine and other water purifiers. No primer is needed. Full details from Tropical Paint Company, Cleveland 2, Ohio, or circle No. **5-22** on the coupon.

Graver Hard Water Bypass for Zeolite Softeners

At times it is necessary to treat water to produce a controlled degree of hardness rather than complete softness. For this need, Graver has an effective zeolite bypass which controls the proportionate mixing of untreated hard water and softened water to produce whatever degree of hardness is desired. Only a single setting (on the adjustable orifice) need be made to regulate the ratio of hard water to soft. Valves are automatic and adjust rapidly and surely to flow variations of one to four, without any perceptible loss of accuracy. There are no pumps and a minimum number of moving parts.

There are many uses for this device including controlled-scale corrosion prevention; municipal water supply; and wherever it is preferable to use simple zeolite softening without producing a zero-hardness water. More from Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y., or circle No. **5-23** on the coupon.

New Multi-Function Control System

Synchro-Scan, a new multi-function supervisory control system utilizing a single pair of signal wires and supervised by one operator, permits remote control of any combination of pumps, valves, gates, generators, circuit breakers, etc. from a central dispatching station. Synchro-Scan's components also accomplish two-way transmission of multiple telemetering and advisory functions thereby permitting the operator to supervise all system operations. This control system offers reduced cost through less man hours and leased telephone lines, increased dependability of operations, better quality service, and low cost system expansion because of "plug-in" unit construction. In addition to utilizing private or leased lines as transmission media, Synchro-Scan Supervisory Control transmits over audio tone channels, modulated carrier frequencies and microwave links. More about all this from Builders-Providence, Inc., 345 Harris Ave., Providence, R. I. or circle No. **5-24** on the coupon.

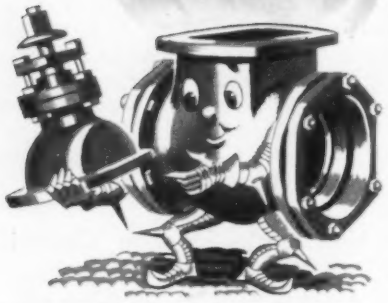
Caterpillar 230-HP Crawler With Turbocharged Engine

Drawing on 50 years of track-type manufacturing experience, Caterpillar Tractor Co. has announced the D9X, a 230-hp crawler tractor for the heaviest kind of work. The photo herewith shows one of these machines operating a self-loading grader near Birmingham, Ala., on a contract held by Moss-Thorton. Weight is 28 tons.

Results of Traffic Tests on Veon Plastic Markings

A new plastic traffic marking compound, Veon, was applied last September to a section of Fifth Ave., New York. Since that time approximately a million and a half vehicles and countless pedestrians have passed over these markings. An investigation by the U. S. Testing Co. five months later—Feb. 15, 1955—found that this plastic line was still in excellent condition. An advantage noted at the time of placement was that Veon dried within 15 seconds sufficiently to prevent any pickup by traffic; and also that the application was unusually easy and rapid, using only a 2-man crew.

Replacement parts never a problem!



Backed by more than 100 years of successful operations, Eddy Valve Company has always maintained interchangeability of repair parts. That's one of many reasons why thoughtful, "look-ahead" engineers and purchasing agents specify . . .

EDDY valves for:

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- Furnished with bell, flange or mechanical joint connections to fit any existing or planned installation.
- 105 years of successful operations assure availability of repair parts.
- Conform to all A.W.W.A specifications.

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—Worth Seeing

W. Sidney Park, newly elected president, the American Society of Photogrammetry, presents the past president's emblem to Arthur Lundahl, retiring president, at the annual meeting. Park is president of Aerial Surveys, Louisville.

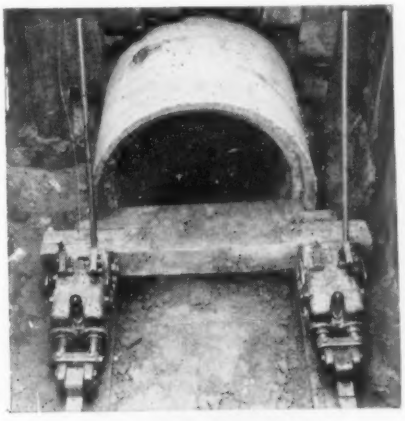
Aluminum breaks out in a new place! Now it is in the Lifetime Aluminum Diving Board, designed by the famous diving expert, Jim Patterson, and distributed internationally by American Playground Device Company of Anderson, Ind. If you ever had an old style diving board break under you just as you were about to astonish the assembled multitude—and your best girl—with your feats of diving skill you will know the need that this new diving board of durable aluminum meets. It costs more per board but less per year. This one is at the Hotel Fontainbleau pool at Miami Beach, Florida.

Sand, not snow as it appears, is what is being moved by this Tournatractor. It is dozing sand borrowed from the Gulf of Mexico at Pensacola Beach, Fla. to build up the area for housing lots. Beach is 40 miles long, 1,000 feet to 1½ miles wide.

FAST, EASY WAY TO INSTALL PIPE... AT LOWER COST

PUSH PIPE UNDERGROUND WITH A GREENLEE HYDRAULIC PUSHER

Here's the simple, cost-cutting way to install underground pipe. Speed your jobs with a GREENLEE Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, backfilling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes — model shown above for pushing 3/4" to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump (as shown above) also available for extra ease and speed of operation.



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GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 2045 Columbia Ave., Rockford, Ill., U.S.A.

If management could design a business building

Butler buildings cover 185,000 square feet of space—at dramatically low cost, for The Coleman Company, Inc.

it would have these BUTLER features

If management could redesign the "shirtsleeves" buildings of business—factories, warehouses, outlets—everyone would agree that high costs are the first problem—cost of materials, erection, expansion, alteration, maintenance. Butler steel buildings have already solved these problems—and several more besides. Steel and aluminum need little care. Steel clear-span frames make every cubic foot of interior usable. Bolted assembly makes erection quick and easy. Bolted apron walls make expansion or alteration economical. Mass production produces buildings to high quality standards—for about the price you'd pay for cheapest construction. For proof—mail coupon today.

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WORTH TELLING

by Arthur K. Akers

★ BYRON JACKSON CO. of Los Angeles elects four new vice presidents, including Norman D. Jesse, in charge of sales, service, and branches of Pump Division.

★ RHODIA, INC., New York, appoints Paul Brna as engineering representative in the mid-continent area. See Rhodia's new advertisements in PUBLIC WORKS for the rest of their story.

★ RICHARD H. KOEHLER, advances from advertising and sales promotion manager of its LeRoi Division to director of advertising and publicity of the parent company, Westinghouse Air Brake Co., in Pittsburgh. He succeeds Joe H. Serkovich, now with a Chicago advertising agency.

Mr. Koehler

Mr. Irving

★ JAMES E. IRVING becomes president, Western Division, of the Irving Subway Grating Co. in Oakland, Calif. He also retains his duties as executive vice president of the parent company in Long Island City, N. Y.

★ OUR NO. 1 READER, Dave Gallagher, manager of Public Works Division, Worthington Corporation, calls attention to an ambiguity in this column for March. Thomas J. Kehane of Worthington *was* assistant vice president and sales manager; he is *now* vice president in charge of sales. Clarification is cheerfully printed.

★ G. A. (Gerry) FLEET CO., sanitary equipment manufacturers' representatives, are now to be addressed P. O. Box 38, North Station, White Plains, N. Y.

Mr. Steinwender

★ SHELLER L. STEINWENDER has been appointed vice president of The Permutit Company, New York, manufacturers of water conditioning equipment. Prior to joining Permutit, Mr. Steinwender, a chemical engineer, was vice president of the Scaife Company, Pittsburgh, and before that was with the A. O. Smith Corporation and the American Cyanamid Co.

★ CHARLES E. KAUFMAN has been appointed manager of a newly-created chemical product development department for Hagan Corporation and its subsidiaries, Calgon Inc. and the Buromin Co. of Pittsburgh. He was formerly director of research for Hall Laboratories, Inc., another Hagan subsidiary.

★ AT PORTLAND CEMENT ASSOCIATION, Chicago, James D. Piper has been named vice president for promotion, and W. D. M. Allan, vice president and secretary.

★ A. C. "Burt" KRAFT, who has been district representative for the Caterpillar Tractor Co. in London, is now manager of their New York office. J. B. Wilson, moves to Peoria from New York as assistant export manager, Latin American Division.

★ DEMPSTER BROTHERS Inc., Knoxville, are named eastern Tennessee distributors for the complete line of Huber-Warco rollers and graders. Another Dempster division manufactures and distributes the Dempster - Dumpsters, Dempster - Diggsters, etc.

★ THE DOCTOR'S waiting room was well *named*. At last one elderly long-waiting patient stood up wearily and remarked: "Well, I guess I'll just go home and die a natural death."

—*Johnson's National Well Driller*

R is for Reliability

Each one of a dozen cities has relied upon and been faithfully served for more than a dozen years by its Nichols Herreshoff incinerator . . . without a single emergency arising in sludge disposal.

Nichols Herreshoffs have and will run for months and years without a shut-down for repairs. Many of these units in operation today have not been shut down for repairs in over a year.

No other method of sludge incineration can better the Nichols record nor, to date, has any other method equaled its record . . . that's Reliability.

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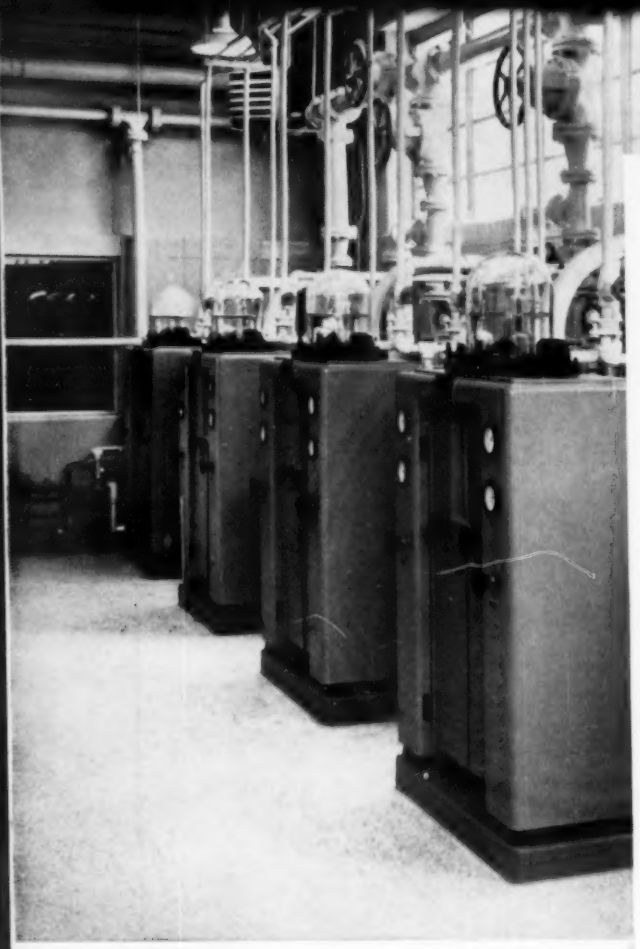

CITY OF HOUSTON

ROY HOFHEINZ, *Mayor*

UTILITIES DEPARTMENT

San Jacinto Water System
12555 Clinton Drive
Houston 15, Texas
January 13, 1955

Wallace and Tiernan
1112 National City Bank Building
Dallas, Texas

Gentlemen:

The initial installation of 14 Wallace and Tiernan Water Diaphragm Chlorinators in Houston was made in mid-1929 under my supervision. Since that time the number of your chlorinators has increased to 35 at the present time.

The most recent installation was last year in your furnishing and installing four 6000 lb. per day Chlorinators at the Houston Water Purification Plant.

In addition to Wallace and Tiernan Chlorinators, we have 7 of your Chlorine Residual Recorders which were installed under my direction.

In our dealings with your organization for more than a quarter of a century we have relied on your personnel for service and technical advice and to this time have not been disappointed. Your equipment has stood the test of time and has been used under many adverse conditions and always with satisfactory performance.

Very truly yours,

Clyde R. Harvill

Clyde R. Harvill
Superintendent
San Jacinto Water System

W&T WATER DIAPHRAGM EQUIPMENT

"...has stood the test of time..."

At Houston's San Jacinto Water System, W&T equipment — some of which is shown above — "has stood the test of time and has been used under many adverse conditions and always with satisfactory performance," according to Mr. Clyde R. Harvill, Superintendent. This dependability and long life result not only from proper design, but from the selection of the right parts and materials for every specific purpose.

Since 1913, W&T research has consistently sought out new designs, principles and materials. Every new development is placed under rigid field tests to prove it can meet the exacting standards that dependable and economical chlorination demands.

When you depend on W&T equipment, you have the assurance that 40 years of experience in the chlorination field is being used to bring you the best in design, parts and materials — selected to stand the test of time.

"Make Your First Choice Equipment That Lasts."

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